A Phylogenetic Analysis of the Bee Tribe Epeolini, with a Review of the Genus *Triepeolus*

by Molly Greer Rightmyer

Professor in Charge
Charles Michener

Committee Members
Orley R. Taylor
Edward O. Wiley
William C. Johnson

A PHYLOGENETIC ANALYSIS OF THE BEE TRIBE EPEOLINI, WITH A REVIEW OF THE GENUS *TRIEPEOLUS*

By

Molly Greer Rightmyer

Submitted to the Department of Ecology and Evolutionary Biology and the
Faculty of the Graduate School of the University of Kansas
In partial fulfillment of the requirements for the degree of
Doctor of Philosophy

_____
chairperson

Committee Members

_____

_____

_____

Date defended: _____

The Dissertation Committee for Molly Greer Rightmyer certifies
that this is the approved version of the following dissertation:

A PHYLOGENETIC ANALYSIS OF THE BEE TRIBE EPEOLINI, AND A COMPREHENSIVE REVIEW OF AND KEY FOR THE SPECIES OF THE GENUS *TRIEPEOLUS*

Committee:

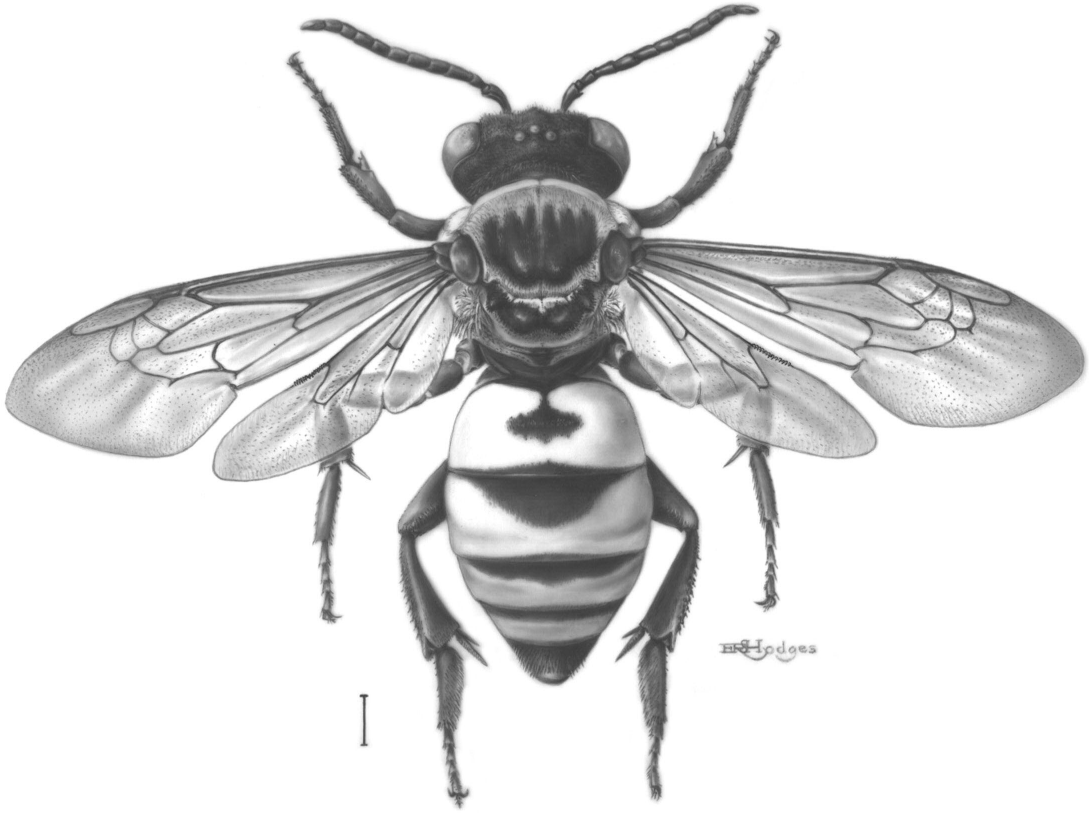
_____
Chairperson

_____

_____

_____

Date approved _____



Triepeolus concavus (Cresson)

ABSTRACT

A generic-level cladistic analysis of the cleptoparasitic bee tribe Epeolini (Apinae: Nomadinae) is presented. One hundred and two characters of adult external morphology are identified and coded for 32 species representing all genera and subgenera presently recognized within the tribe, along with five outgroup taxa. The resulting topology is used in the formation of a higher-level classification of the tribe. Four subtribes are characterized: Odyneropsina Handlirsch, Rhogepeolina Rightmyer, Epeolina Robertson, and Thalestriina Rightmyer. *Pseudepeolus* and *Triepeolus* are not supported as subgenera of *Doeringiella* and are elevated to generic rank. The subgenus *Trophocleptria* renders *Epeolus* sensu stricto paraphyletic and is synonymized. The group *Parammobates* is recognized as a subgenus of *Odyneropsis*. A key to the genera of the tribe is provided. The taxonomic history of the tribe, as well as available information on hosts and biology of epeolines is summarized.

In addition, a study of the species of *Triepeolus* is presented, with three separate keys. The first key is for the females of species occurring in North and Central America, excluding those of the *T. verbesinae* and *T. simplex* species groups. The second and third keys are for both sexes of all *Triepeolus* species found in eastern North America, and in South America and the Caribbean, respectively. Diagnoses, geographical ranges, host and floral records, and flight times are recorded for each species presented in the keys, with the addition of several well-defined species belonging to the *T. verbesinae* and *T. simplex* species

groups. A total of 103 species, excluding those in the *T. verbesinae* and *T. simplex* species groups, are recognized. Fifty-two species names are newly synonymized (Table 6 and Appendix 5). The currently known and suspected host relationships for *Triepeolus* species are summarized (Appendix 3), and a list of the *Triepeolus* species found in various geographical regions is presented (Appendix 4).

ACKNOWLEDGEMENTS

I thank John S. Ascher, J. S. Ashe, Stelios Chatzimanolis, Peter S. Cranston, Bryan N. Danforth, Michael S. Engel, Terry L. Griswold, Charles D. Michener, Jerome G. Rozen, Jr., and Natapot Warrit for advice and discussions that have greatly improved this work. Additionally, I thank Charles D. Michener for examining morphological characters used in the phylogenetic analyses of Epeolini, and Charles D. Michener, Rebekah Andrus, and Marie Wendel for offering feedback on the keys to *Triepeolus* species. Scanning electron microscopy work at the American Museum of Natural History was generously arranged by Jerome G. Rozen, Jr., Angela Klaus, and Kevin Frishmann. I thank Michael S. Engel and J. S. Ashe for making their Microptics camera systems available for my work. Robert W. Brooks, Michael S. Engel, Charles D. Michener, and Zachary H. Falin are gratefully acknowledged for facilitating loans from many of the institutions listed in the Materials section. I thank John S. Asher for providing access to primary literature housed at the American Museum and for bringing several host associations to my attention. Elaine R. S. Hodges is gratefully acknowledged for permission to borrow her masterful illustrations of *Triepeolus*, which she created for Paul Hurd during his tenure at the Smithsonian Institution (Frontispiece, and Figs. 18 and 459–489). For providing these illustrations, I thank Scott Miller and George Venable, also of the Smithsonian Institution. Darci B. Falin and Sara L. Taliaferro generously provided instruction and resources for the completion of the photographs and figures found herein.

Favizia F. de Oliveira and Gabriel A. R. Melo are thanked for providing photographs of specimens found in Curitiba, Brazil. Caleb Morse is thanked for advice regarding plant taxonomy and nomenclature.

I am greatly indebted to each of the individuals who loaned specimens used in this study; the list of those individuals can be found in the Materials section. During my search for missing holotypes, a number of people kindly provided information about specimens found in their respective institutions. For this service I thank C. van Achterberg (Nationaal Natuurhistorisch Museum, Leiden, The Netherlands), Hannes Baur (Naturhistorische Museum der Burgergemeinde, Bern, Switzerland), Christy Bills (University of Utah Museum of Natural History, Salt Lake City), C. Roberto F. Brandão and Beatriz Coelho (Museu de Zoologia da Universidade de São Paulo, Brazil), Daniel Burckhardt (Naturhistorisches Museum, Basel, Switzerland), Michael S. Caterino (Santa Barbara Museum of Natural History, California), Paula Cushing (Denver Museum of Nature and Science, Colorado), Roy Danielsson (Zoologiska museet, Lunds Universitet, Sweden), Ismael Hinojosa-Diaz (Universidad Nacional Autónoma de México, Mexico City), Chris Durden (Texas Memorial Museum, Austin), Willem Hogenes (Instituut voor Taxonomische Zoölogie, Amsterdam, The Netherlands), Joe Keiper and Thomas Pucci (Cleveland Museum of Natural History, Ohio), Jens-Peter Kopelke (Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt, Germany), Steve Matter (Cincinnati Museum of Natural History, Ohio), Donald McFarlane and Jonathan Wright (Joint Sciences Department and

Pomona College, of the Claremont Colleges, California), Yuri A. Pesenko (Zoological Institute, the Russian Academy of Sciences, St. Petersburg), Raymond J. Pupedis (Peabody Museum of Natural History, Yale University, Connecticut), Leslie L. Skibinski (Delaware Museum of Natural History, Wilmington), Lars Vilhelmsen (Zoologisk Museum, Københavns Universitet, Denmark), Claire Villemont (Musée National d'Histoire Naturelle, Paris, France), Kate Wellspring (Amherst College, Pratt Museum of Natural History, Massachusetts), Wu Yan-Ru (Academia Sinica, Beijing, China), and Herbert Zettel (Naturhistorisches Museum, Wien, Austria).

I thank the following people and organizations for funding my graduate research: the American Museum of Natural History; the Philanthropic Educational Organization (Chapter MH, Missouri); the National Science Foundation; the United States Department of Agriculture; the University of Kansas Graduate School, Natural History Museum and Biodiversity Research Center, and Entomology Program Endowment; Charles and Jennie Rightmyer; and Clayton and Margaret Depue.

Finally, I am grateful to Charles Michener for serving as the main advisor to my dissertation, to Steve Ashe for co-advising my work before his untimely death, and to Deborah R. Smith for not hesitating to take me under her wing after Steve's passing. I also thank the members of my committee, Orley R. "Chip" Taylor, Edward O. Wiley, and William C. Johnson, for their advice and encouragement during my graduate work. For their friendship and moral support,

I especially thank Charles Michener, Natapot Warrit, and my family—Charles and Jennie Rightmyer, Joli Rightmyer, Clayton and Margaret Depue, Edward Marquette, and Jennie Marquette.

TABLE OF CONTENTS

INTRODUCTION

The tribe Epeolini is a diverse assemblage of parasitic bees in the subfamily Nomadinae. Most of the genera are found in South America; however, the two most species-rich genera, *Triepeolus* and *Epeolus*, are widely distributed, with the latter found on all continents except Australia (and Antarctica). Epeolines parasitize a wide variety of distantly related bees in the families Colletidae (Colletinae and Diphaglossinae), Andrenidae (Oxaeinae), Halictidae (Nomiinae), and Apidae (Emphorini, Eucerini, and Anthophorini) (Rozen, 2001); circumstantial evidence suggests that certain species of *Triepeolus* may additionally parasitize species in the family Megachilidae (Osmiini), Melittidae (Dasypodaini), and the tribe Centridini of the Apidae (see Appendix 3). The mode of parasitism in epeoline bees is typical for all known Nomadinae: the female enters an open cell while the host is away foraging, inserts her egg in a slit or hole in the cell wall, and departs. The egg hatches into a hospicidal first larval instar, equipped with long, sickle-shaped mandibles with which it kills the host egg or larva and consumes its intended provisions (Rozen, 1989b, 1991). According to Michener (2000), the tribe consists of six genera, several of which contain two or more subgenera or species groups (Table 1). As the result of the present analysis, I herein refer to *Doeringiella* sensu stricto, *D*. (*Pseudepeolus*), and *D*. (*Triepeolus*) (sensu Michener, 2000) as *Doeringiella*, *Pseudepeolus*, and *Triepeolus*, respectively.

This study was prompted by the discovery of *Triepeolus epeolurus* Rightmyer (2004a), a species that combines some of the characters of the pseudopygidial area historically used to differentiate *Epeolus* from *Triepeolus*. Further investigations into the diversity of *Triepeolus* made apparent the need for a more robust understanding of epeoline phylogenetic relationships. The purpose of the present study is to resolve the phylogenetic relationships of the genera and subgenera within Epeolini, to refine the current understanding of the species belonging to *Triepeolus*, and to provide the keys to the species of *Triepeolus* found throughout the New World.

Table 1. Classification of the bee tribe Epeolini.

Michener (2000):	Present study:
	Subtribe ODYNEROPSINA
Genus ***Odyneropsis***	Genus ***Odyneropsis***
"Species group" *Odyneropsis*	Subgenus *Odyneropsis*
"Species group" *Parammobates*	Subgenus *Parammobates*
	Subtribe RHOGEPEOLINA
Genus ***Rhogepeolus***	Genus ***Rhogepeolus***
	Subtribe EPEOLINA
Genus ***Epeolus***	Genus ***Epeolus***
Subgenus *Epeolus* sensu stricto	
Subgenus *Trophocleptria*	
	Subtribe THALESTRIINA
Genus ***Doeringiella***	Genus ***Doeringiella***
Subgenus *Doeringiella* sensu stricto	Genus ***Pseudepeolus***
Subgenus *Pseudepeolus*	Genus ***Triepeolus***
Subgenus *Triepeolus*	
Genus ***Rhinepeolus***	Genus ***Rhinepeolus***
Genus ***Thalestria***	Genus ***Thalestria***

HISTORICAL REVIEW

Latreille (1802) named the first epeoline genus, *Epeolus*, and placed it in the solitary division of the family Apiariae, along with *Nomada* and *Melecta*. More than 50 years later, Smith (1854) named *Thalestria* and placed it with a diverse group of bees (e.g., Megachilidae, Melectini, and Euglossini) in the subfamily Denudatae. *Doeringiella*, *Pseudepeolus*, and *Trophocleptria* were named by Holmberg (1886a, 1886c), who remarked on the morphological similarity of these genera to each other as well as to the brachynomadine genus *Brachynomada*, which he also described in the same year (Holmberg, 1886b). The distinctive genus *Odyneropsis* was described by Schrottky (1902); shortly thereafter Friese (1906) proposed the genus *Parammobates* for a related group.

Gribodo (1894) placed species of *Epeolus* with three maxillary palpal segments into the subgenus *Diepeolus* ("*Di-*" for the two articulations of the segments). He further proposed that, for the love of symmetry ("questo amore della simmetria"), those species with two palpal segments be named *Monoepeolus*. This idea was echoed by Robertson (1901), who proposed the genus *Triepeolus* for those *Epeolus* with three maxillary palpal segments. Although it is now known that palpal segment number does not reliably differentiate *Triepeolus* from *Epeolus*, Robertson was fortunate to include species that are morphologically distinct from *Epeolus* in his generic description of *Triepeolus*. Several of these other characters, including the female pseudopygidial area and sixth sternum, were soon recognized by Robertson

(1903), yet he still used maxillary palpal segment number to differentiate genera. This is exemplified by his 1903 proposal of the genus *Argyroselenis*, which was based on a species with female pseudopygidial area and sixth sternum characteristics of *Epeolus*, but which also had three maxillary palpal segments. Thus, Robertson's *Argyroselenis* is synonymous with Gribodo's *Diepeolus*, which in turn is synonymous with *Epeolus*. Similarly misleading characters were used by other workers (e.g., Ashmead, 1899; Cockerell, 1921; and Mavromoustakis, 1954) to recognize other epeoline groups that have since been synonymized.

Using the diagnostic characters given by Robertson (1903), Bischoff (1930) was the first to place certain Old World epeolines (*Triepeolus tristis* and *Epeolus tsushimensis*) into the genus *Triepeolus*; however, the latter species has been shown to belong to the genus *Epeolus* (Rightmyer, 2004b).

Grütte (1935) proposed the close relationship of the epeoline genera (although he considered *Doeringiella*[1] to be synonymous with *Brachynomada*), and excluded from them a great number of taxa that had been previously grouped with them (e.g., *Ammobates*, *Ammobatoides*, *Biastes*, *Coelioxoides*, *Holcopasites*, *Isepeolus*, *Leiopodus*, and *Osiris*, as well as the parasitic melectine and megachiline genera). Based primarily on characters of the mouthparts, wings, and female S6, Grütte considered *Odyneropsis* to be a basal member of the group, and

[1] Grütte seemingly did not observe any specimens of *Doeringiella*, and perhaps relied on published descriptions instead. It is interesting that he considered *Brachynomada* to be so closely allied to epeolines. He apparently considered the genus to be somewhat of an anomaly, and hesitated to place *Brachynomada* in a specific relationship to the epeoline genera. However, he may well have misidentified *Brachynomada*, a genus that does not closely resemble Epeolini, as well as perhaps *Doeringiella*.

hypothesized that *Thalestria* and *Triepeolus* were more closely related to each other than to the other epeoline genera; in fact, he suggested that *Thalestria* might be a "modified" *Triepeolus*. He further proposed the synonymy of *Parammobates* with *Odyneropsis*, observing that the only significant difference between the two appeared to be size.

Linsley and Michener (1939) provided a comparative study of adult nomadine morphological structures, particularly of male and female terminalia, and recognized Nomadini and Epeolini as separate tribes within the family Nomadidae. Michener (1944) placed the phylogenetic position of Epeolini in a more robust analysis of bees as a whole, and in 1954, proposed the close relationship of most of the genera now considered to be in the subfamily Nomadinae. Concurrently, Moure (1954, 1955) produced the first comprehensive studies of South American epeolines since Holmberg (1886a, 1886c). Moure (1954) proposed the subgenera *Doeringiella* (*Stenothisa*) and *D*. (*Orfilana*), the latter proposed for species whose males lack swollen scapes and whose females have conspicuous pseudopygidial areas. Moure (1955) gave an account of the species of *Odyneropsis* and described three new epeoline genera from South America; these genera, *Rhinepeolus*, *Rhogepeolus*, and *Coptepeolus*, are the last epeoline genera to have been named.

Since Moure (1955), the majority of the systematic work on adult Epeolini has been done by Roig-Alsina, who has undertaken a series of revisions of the species of the South American genera. Roig-Alsina (1989) revised and

determined the phylogenetic relationships among the species of *Doeringiella*. Based on this analysis, he concluded that swollen male scapes independently originated twice within *Doeringiella*; however, a more extensive analysis by Compagnucci and Roig-Alsina (2003) placed such males together as a single clade. Roig-Alsina (1996) expanded the generic definition of *Rhogepeolus* to include the monotypic *Coptepeolus* along with two other closely allied species. In 2003, he revised *Pseudepeolus* and provided a phylogenetic hypothesis of the genus and its close relatives. Michener (2000) proposed the subgeneric status of *Triepeolus* and *Pseudepeolus* under *Doeringiella* based on observations communicated to him by Roig-Alsina; these observations were more fully enumerated by Roig-Alsina (2003). Michener (2000) also recognized *Trophocleptria* as a subgenus of *Epeolus*.

Treatments of *Epeolus* and *Triepeolus* have been limited to various geographical regions. For *Epeolus*, they are Mitchell (1962) for eastern North America, Brumley (1965) for western North America, Eardley (1991) for sub-Saharan Africa, Bischoff (1930) and van Lith (1956) for the Palearctic, Richards (1937) for Great Britain, and Yasumatsu (1933) and Hirashima (1955) for Japan. For *Triepeolus*, they are Mitchell (1962) for eastern North America, Genaro (1998, 1999, 2001) for the Caribbean, and Moure (1955) for South America.

The phylogenetic position of Epeolini within Nomadinae has been addressed by a number of studies based on adult and mature larval data sets (Alexander, 1990, 1996; Roig-Alsina, 1991; Roig-Alsina and Michener, 1993;

Rozen, 1996; Rozen et al., 1978, 1997). While these studies have not unambiguously resolved the sister taxon to Epeolini, they have shed some light on which tribes are likely to be closely related. These tribes are characterized by a particular type of female S6, termed the "nomadine type" by Roig-Alsina (1991), in which the lateral lobes bear spine-like setae as opposed to forming two conical points. The taxa characterized by this type of S6 are the tribes Ammobatoidini, Biastini, Brachynomadini, Epeolini, Hexepeolini, Nomadini, and Townsendiellini. All of these tribes, except for Biastini and Townsendiellini, have been supported as sister to Epeolini in one or more of the analyses cited above, depending upon what taxa and characters are used to create the phylogenetic hypothesis (see Table 3). Other topologies obtained by these authors resolved Epeolini nested within the phylogeny, such that a sister taxon was resolved for Epeolini plus a clade containing several other tribes. In these cases, either *Hexepeolus* (Rozen, 1996) or *Nomada* (Rozen, 1996; Rozen et al., 1997) was resolved as the sister taxon to the clade composed of Epeolini and other nomadine tribes. As discussed by Rozen (1996), the wide variety of phylogenetic hypotheses proposed by these authors is likely reflective of the fact that different taxa and character sets were employed in each study.

The biology of most epeoline species remains largely unknown; however, studies of egg, larval, and pupal morphology and modes of parasitism (some of them comparative) were provided by Claude-Joseph (1926) for *Doeringiella*; Michener (1953), Rozen (1966, 1989b), Rozen and Favreau (1968), McGinley

(1981), and Torchio and Burdick (1988) for *Epeolus*; Rozen (1996) for *Thalestria*; Mayet (1875)[2], Graenicher (1905), Michener (1953), Bohart (1966, 1970), Rozen (1966, 1984, 1989b), Nielsen and Bohart (1967), McGinley (1981), Torchio (1986), and Wuellner and Hixon (1999) for *Triepeolus*; and Rozen (1966) for *Odyneropsis*. Rozen (1989b) highlighted characters of first larval instars that serve to differentiate several species of *Epeolus* and *Triepeolus*. Information on various epeoline taxa can also be found in Rozen's (2001) key to the mature larvae of parasitic genera and his (2003) listing of the number and size of mature oocytes and the ovariole number of parasitic taxa.

Host associations for some epeoline genera have been known more than a century (e.g., Robertson, 1901). In contrast, the hosts of other genera (e.g., *Rhogepeolus*, *Rhinepeolus*) remain unknown or speculative. A summary of currently known host records for epeoline genera is found in Table 2.

[2] It is possible that Mayet was describing an *Epeolus* species in this paper; she considered *Triepeolus tristis* to be synonymous with *Epeolus luctuosus* and *Epeolus speciosus* (p. 81), and the bee she observed was parasitizing nests of *Colletes*.

Table 2. Number of species, geographical distribution, and host records for genera of Epeolini[1]. Question marks indicate uncertain host associations.

Genus	No. of species	Geographical distribution	Hosts
Odyneropsis	12	Neotropical; 1 sp. in southwest USA	*Ptiloglossa* (Colletidae)
Rhogepeolus	5	South America	Unknown
Epeolus	ca. 110	Worldwide, excluding Australia, tropical India, southeast Asia	*Colletes* (Colletidae)[2]
Doeringiella	35	South America	Eucerini (Apidae), possibly *Diadasia* (Apidae), *Caupolicana* (Colletidae)
Pseudepeolus	5	South America	Unknown
Rhinepeolus	1	South America	Unknown
Triepeolus	ca. 140	New World; 1 sp. each in Europe and Asia	Eucerini (Apidae), *Anthophora*, *Centris*?, *Melitoma*? (Apidae), *Caupolicana*, *Ptiloglossa* (Colletidae), *Protoxaea* (Andrenidae), *Dieunomia*, *Nomia* (Halictidae), *Atoposmia*? (Megachilidae), *Hesperapis*? (Melittidae)
Thalestria	1	Neotropical	*Oxaea* (Andrenidae)

[1] Information in this table is modified from Michener (2000) and Roig-Alsina (2003).
[2] Medler (1980) included *Tetralonia* (Eucerini) in his host list of *Epeolus*; this host association seems dubious.

MATERIALS

Specimens used in this study were borrowed from the following individuals and institutions. The city where each institution and/or individual is located is used below to indicate where specimens are preserved. **ANN ARBOR**—University of Michigan Museum of Zoology (M. F. O'Brien); **ANSFELDEN**—Maximilian Schwarz, personal collection, Austria; **AUSTIN**—Central Texas Melitological Institute (J. L. Neff); **BERKELEY**—Essig Museum of Entomology, University of California (C. Barr); **BERLIN**—Zoologisches Museum, Humboldt-Universität (F. Koch); **BOULDER**—University of Colorado Museum (V. Scott); **BRUSSELS**—Institut royal des Sciences naturelles de Belgique (J. Constant); **CHAMELA**—Estación de Biología, Universidad Nacional Autónoma de México, Jalisco (R. Ayala); **CORVALLIS**—Oregon State Arthropod Collection (J. Leathers); **CURITIBA**—Universidade Federal do Paraná, Brazil (G.A.R. Melo, D, Urban, and F. F. de Oliveira); **DAVIS**—Bohart Museum of Entomology, California (R. Thorp and L. Kimsey); **FUKUOKA**—Kyushu University, Japan (O. Tadauchi); **GAINESVILLE**—Florida State Collection of Arthropods (J. R. Wiley); **HEREDIA**—Instituto Nacional de Biodiversidad, Costa Rica (A. Lépiz); **IOWA CITY**—Chris Gienapp, personal collection, Iowa; **ITHACA**—Cornell University Insect Collection, New York (E. R. Hoebeke and B. N. Danforth); **LAWRENCE**—University of Kansas Natural History Museum and Biodiversity Research Center (C. Michener, M. Engel, and Z. Falin); **LAWRENCE-BAKER**—Donald and Madge Baker Collection, at the University of Kansas Natural History Museum and

Biodiversity Research Center; **LIMA**—Museo Nacional de Historia Natural de la Universidad Nacional Mayor de San Marcos, Peru (C. Rasmussen and G. Lamas); **LOGAN**—USDA-ARS Bee Biology and Systematics Laboratory, Utah (T. L. Griswold); **LONDON**—The Natural History Museum, U. K. (G. Else and C. Taylor); **LOS ANGELES**—Los Angeles County Museum of Natural History, California (Roy Snelling); **MILWAUKEE**—Milwaukee Public Museum, Wisconsin (G. R. Noonan); **NEW YORK**—American Museum of Natural History (J. G. Rozen, Jr., J. S. Ascher, and V. Giles); **NEW YORK-ASCHER**—J. S. Ascher personal collection; **OTTAWA**—Canadian National Collection of Insects, Ontario (L. Dumouchel); **PHILADELPHIA**—Academy of Natural Sciences, Pennsylvania (J. Weintraub); **PUEBLA**—Universidad de las Américas, Mexico (C. Vergara); **QUÉBEC**—Université Laval, Collection Provancher (J.-M. Perron); **RALEIGH**—North Carolina State University Insect Collection (R. Blinn); **RIVERSIDE**—University of California Entomology Research Museum (D. Yanega); **SAN DIEGO**—San Diego Natural History Museum, California (D. Faulkner); **SAN FRANCISCO**—California Academy of Sciences (N. D. Penny, W. J. Pulawski, and R. Zuparko); **STARKVILLE**—Mississippi Entomological Museum (T. L. Schiefer); **TEMPE**—Arizona State University (M. E. Douglas); **TERRE HAUTE**—Robert P. Jean, personal collection, Indiana; **TORONTO**—Royal Ontario Museum (T. Romankova); **TUCSON**—University of Arizona (C. A. Olson); **UNIVERSITY PARK**—Frost Entomological Museum, Pennsylvania State University (R. A. Byers); **URBANA**—Illinois Natural History Survey, Illinois (C. Favret); **WEST**

LAFAYETTE—Purdue Entomological Research Collections, Indiana—A. Provoncha; **WASHINGTON, D. C.**—United States National Museum of Natural History (D. Furth, B. P. Harris, and M. Melo); **ZILLAH**—Eugene R. Miliczky, personal collection, Washington.

Specimens were examined, illustrated, and measured using an Olympus SZX9 dissection microscope, drawing tube, and ocular micrometer or calipers. Photomicrographs were taken using MicrOptics Digital Imaging Systems. Scanning electron micrographs were produced using a Hitachi S4700 Field Emission SEM with uncoated specimens. Dissected male and female terminalia were cleared using ca. 10% potassium hydroxide in water at room temperature and stored in glycerin in microvials on pins with the dry specimens.

MORPHOLOGY

The morphological terminology used herein follows that proposed by Michener (1944, 2000), except for certain terminology proposed by Michener and Fraser (1978) for mandibular structure, Engel (2001) for wing veins, Roig-Alsina (1991) for female S6, and Scudder (1961) and Packer (2003) for female genitalia and associated internal terga, respectively. The following morphological abbreviations are used in the text: intertegular width (ITW), flagellar segment (F), metasomal tergum (T), metasomal sternum (S), and ocellar diameter (OD).

Special descriptive terms and phrases used in this paper, particularly in the descriptions of *Triepeolus* species, are as follows: The clypeal *midline* is a glabrous, sometimes elevated, longitudinal line at approximately the midpoint of the clypeus (Figs. 461–463). The midline is often more noticeable basally on the clypeus. The *larger punctures* of the clypeus are punctures that are distinctly larger than the other, generally more numerous, punctures found on the clypeus (Fig. 462). These larger punctures are not found in all *Triepeolus* species. The *paramedian bands* are paired, longitudinal bands of pale setae on either side of the middle of the scutum. The *intertegular width* is the distance between the inner margins of the tegulae, measured at the middle. The *intercoxal area* is a diamond-shaped region of integument found between the middle coxae, in ventral view. The *midpoint of the scutellum* is the approximate longitudinal middle of the scutellum, when viewed dorsally (not taking into account the posterior surface of the scutellum, which is typically not fully visible in dorsal view). The *T1*

interspace is the region of dark brown or black setae found medially on that tergum, and which is typically partially or fully margined by bands of yellow or white setae (Fig. 18). When referring to the bands of yellow or white (often more simply termed "pale") setae on the metasoma, the *transverse bands* are those found on apically or basally on the tergum, while the *longitudinal bands* are those found laterally on the tergum (Fig. 18). The T5 usually has a wide region of pale setae laterally on either side of the pseudopygidial area (defined below); this region of pale setae is termed the *pale lateral setae of the T5*. When describing the pseudopygidial area, the *base* or *basal region* is that region or margin of the pseudopygidial area basal on the tergum. In many species of *Triepeolus*, this basal region is differentiated by silvery setae. Sometimes the pseudopygidial area is distinctly triangular in shape; when this is the case, the base of the pseudopygidial area is the pointed end of the triangle (e.g., Fig. 265), and is not to be confused with what is sometimes considered the base, or flat edge, of the triangle. A pseudopygidial area that is described herein as *semicircular* resembles half of a circle, while an *ovate* pseudopygidial area is one that is round, but not perfectly circular. The *transverse basal ridge* of the male pygidial plate is a carina, sometimes rather weak and/or broken by punctures, which is found in some *Triepeolu*s species, and which demarcates the transition between the *apical downturned plate* and the basal region of the T5 (Fig. 19). Occasionally, it is possible to differentiate an apical plate that is distinctly downturned from the base of the T5, without the presence of a transverse basal ridge.

The following is a discussion of the morphological terminology used herein pertaining to the female sting apparatus and associated structures, as well as the male internal sclerites. Several of the structures are specific to nomadine bees and thus might be poorly known by many systematists not working directly with this group.

PSEUDOPYGIDIAL AREA

In female Nomadinae, the field of dense setae borne medioapically on T5 is termed the *pseudopygidial area*, so named because this region of modified setae often resembles the overall shape and position of a pygidial plate. This area is likely homologous to the prepygidial fimbria found in other bees (Michener, 2000), which in those bees possibly functions as a means of gathering loose sand from the nest (Grütte, 1935). The setae of the pseudopygidial area generally are simple (i.e., not branched) and are variously modified into a wide array of morphologies. A survey of the remarkable diversity of the setae found in the pseudopygidial region is presented in the scanning electron micrographs (Figs. 179–191) and many of the photographs (Figs. 192-458) found herein (see also Rozen, 1989a). The setae lateral and basal to the pseudopygidial area are usually branched. The function of the pseudopygidial area is not known, although the setae of this area are frequently reflective, perhaps because they are unbranched and flattened. In many epeolines, the pseudopygidial setae resemble those found on the posterolateral corner of the metatibia.

STING APPARATUS

The sting apparatus is a complex assemblage of tergal, sternal, and genital sclerites. A generalized representation of the sclerites of the sting apparatus, their synonymous names, and their articulations are shown in Figure 1 for the genus *Triepeolus*. In nomadine bees, these sclerites are articulated such that the sting and processes of the S6 are able to achieve a certain amount of mobility and flexibility. These structures attain even greater mobility in some epeoline genera primarily due to two morphological adaptations. Within Thalestriina (especially *Thalestria* and some *Triepeolus*), the disk of the female S6 is greatly reduced, and is positioned basally on the sternum relative to the mediolateral apodemes (defined below; Figs. 7, 9, and 10). Consequently, the processes are much less restricted in their ability to move in more than one plane. Also, within Thalestriina (*Doeringiella*, some *Triepeolus*, and especially in *Thalestria*) the *lateral process* of hemitergite 7 (T7; i.e., the part that articulates with S6) is elongate (Figs. 1, 162, and 163). This elongation allows the S6 as a whole to be extruded further from the apex of the metasoma than would otherwise be possible.

The ventralmost sclerite associated with the sting apparatus is the *S6* (Fig. 1). The S6 is a highly modified and character-rich structure in nomadine bees, and presumably plays a role in their particular mode of parasitism. The structure possibly serves a tactile function for the female to orient herself in the cell, and likely helps to position the parasitic egg within the cell wall of the host nest, as a means of transferring the egg from the ovipore to the cell wall. Roig-Alsina

(1991) identified, named, and established the homologies of several structures of the S6; other features are named herein. The various structures of the S6 are labeled in Figures 2 and 7. The apical margin is generally characterized by a median emargination coupled with an elongation of the lateral margins, resulting in the formation of *lateral apical processes*. The extents to which the median emargination and lateral processes are formed vary dramatically within the subfamily and they are essentially absent in at least some *Nomada*. In some nomadines, *principal setae* are born on the ventral apical margin of the lateral processes, and are usually easily distinguished from other setae by their stout appearance. Such ventral setae are absent in *Brachynomada*. A patch of *dorsoapical setae* is also usually present and these setae are likewise somewhat stouter than most other setae found on the S6. In some nomadines, including Epeolini, the principal and dorsoapical setae are separated by flattened integument, termed the *apical plate*. Additionally, nomadines can have a row of setae flanking both the inner and outer margins of the lateral apical processes. These are termed the *marginal setae* and *lateral series of setae*, respectively. The lateral margin of the S6 bears a dorsally directed process that serves as an articulation point with the T7, termed the *mediolateral apodeme*. Once the S6 has been dissected and disarticulated from the T7 and sting, the S6 of many bees flattens into a more two-dimensional structure. This flattening is caused by the inward rotation of the lateral apical processes and the resultant outward, lateral rotation of the mediolateral apodemes (as shown in Figs. 5, 7, and 11); these

apodemes are directed dorsally in life. As in other metasomal sterna, *basal apodemes* are found on the S6. In many Epeolini, the basal apodeme bears a finger-like projection on its median margin, termed the *digitiform appendage of the basal apodeme* (Fig. 7, DBA). A similar but nonhomologous structure is found on the basal margin of the disk of the S6 in some other Nomadinae. When this basal margin is laterally sclerotized, the sclerotization is termed the *basolateral sclerotic band* of the disk (Fig. 2, BSB).

A close inspection of the epeoline female S6 reveals that it appears to be composed of two distinct sclerites; one that includes the basal apodeme and extends up the outer surface of the lateral apical process, and one that includes the central disk of the S6 and extends up the inner surface of the lateral apical process. These sclerites are probably the result of subsegmentation of the S6 to allow for the particular conformation of that sternum.

Within Epeolini, certain female S6 morphologies are highly suggestive of functions related to particular modes of parasitism. In Thalestriina, the claw-like principal setae are suggestive of a digging or tactile function, as discussed above. The modifications for increased S6 mobility also suggest such a function. In *Epeolus*, the principle setae are modified into pointed denticles and the processes that bear these denticles are more rigidly attached to the disk of the sternum (Fig. 13). Both of these features suggest a saw-like function, and might have evolved in response to the cellophane-like lining that coats the cell wall of its host,

Colletes. Observations reported by Torchio and Burdick (1988) support the idea that the *Epeolus* S6 is used in such a manner.

In addition to the largely internalized S6, two completely internalized tergal sclerites are each present as lateral hemitergites, as in other bees. The outermost hemitergite, *T7*, bears a *spiracle* and articulates with S6 ventrally (Figs. 1, 14, and 152–165). The region that articulates with the mediolateral apodemes of the S6 was termed the *lateral process* by Packer (2003). In the same work, Packer identified the region that would be oriented basolaterally in an undivided tergum; this region was termed the *apodemal region*. Similarly, the *lateral margin* was identified as the margin that extends toward the spiracle from the lateral process. These regions are labeled in Figure 14. The innermost hemitergite, *T8*, lacks a spiracle and articulates with the gonangulum ventrally (Figs. 1, 15, and 147–151). The *anterior ridge*, as termed by Packer (2003), marks the margin bordered by the apodeme of the T8 (Fig. 15). Dorsally, T7 and T8 are connected by conjunctival membrane.

In nomadine bees, the *gonangulum* is a small, triangular sclerite that is produced medially into an enlarged flap bordered by a carina. The gonangulum articulates with the T8, second gonocoxa, and ramus of the first gonapophysis (Fig.1). The gonangulum has been termed the first valvifer or gonocoxa by many authors due to its articulation with the ramus of the first gonapophysis. However, Scudder (1961, 1964) has shown that the gonangulum is derived from a portion of the second gonocoxa. Evidence to support this hypothesis comes primarily from

his ability to follow the evolution of the gonangulum throughout Dicondylia based upon its three consistent articulations with ninth abdominal tergum (metasomal T8), the second gonocoxa, and the first gonapophysis—from Zygentoma, where the affinity of the gonangulum with the second gonocoxa is apparent (also observed in *Thermobia* by Michener, 1944), to the more derived orders where the gonangulum becomes fused with a variety of structures (e.g., the ninth abdominal tergum and first gonocoxa). Additional developmental evidence supports the hypothesis that the gonangulum is derived from the second gonocoxa (Scudder, 1964). The first gonocoxa is apparently missing in all Hymenoptera, except perhaps in the Chalcidoidea (Scudder, 1961).

The *second gonocoxa* is a large sclerite that basally articulates with the gonangulum and *ramus of the second gonapophysis* (Fig. 1). Apically, it gives rise to the gonoplac; dorsally and apically it is associated with the weakly sclerotic distal sections of the hindgut.

In bees, the *gonoplac* is a setose structure that encases the sting when it is not in use. Its synonymous names are sting sheath, third gonapophysis or valvula, and gonostylus. Scudder (1961) proposed the term gonoplac to refer to a structure that is positionally homologous to a gonostylus, but which is formed of an outgrowth of the second gonocoxa (as opposed to the gonostylus, which is a moveably attached process of the gonocoxa). The reasons for and against the use of gonoplac as opposed to the other proposed terms were outlined by Scudder (1961, 1971) and will be briefly recounted here. The term sting sheath is not

preferred because it obscures the homology of the structure with that of organisms in which it forms a part of the ovipositor (e.g., Gryllidae), rather than a sheath for the ovipositor or sting. The terms third gonapophysis or valvula are not preferred because they imply knowledge of a serial homology of the gonoplac with the first and second gonapophyses, which in turn are likely homologous with eversible vesicles found on the pregenital segments of Archaeognatha. This seems unlikely because both the gonoplac and second gonapophysis arise from the second gonocoxa. However, if the gonapophyses are homologues of eversible vesicles, as has been suggested by Scudder (1961), then the evidence for the homology of the gonoplac with the gonapophysis is somewhat inconclusive: while *Neomachilis* has only one pair of eversible vesicles per abdominal segments 2–7, *Petrobius* pregenital segments bear two pairs of eversible vesicles per segment. Given the apparently derived position of *Neomachilis* and *Petrobius* within the Machilidae (Sturm and Machida, 2001), it would perhaps be more informative to examine more basal members of the Machilidae and Meinertellidae to determine the groundplan number of eversible vesicles.

The term gonostylus implies the homology of the structure with the styli found on the pregenital segments of Archaeognatha and Zygentoma, which in turn are presumably homologous with the telopodites or possibly the coxal styli of the thoracic legs. Scudder (1971) concluded that both gonostyli and gonoplacs are present in some insect orders, but that only gonoplacs are present in Hymenoptera. Although Scudder believed that female Hymenoptera lack

gonostyli, it seems feasible that the structure found in this order is homologous to the styli of archaeognathan pregenital segments; after all, female hymenopteran genitalia resemble that of Archaeognatha in other ways (Scudder, 1961). Segmentation or pseudo-segmentation of the gonoplac has been observed in a number of bee groups, and apparent full articulation of the gonoplac with the second gonocoxa has been observed in wasps closely related to bees (Packer, 2003). Alternatively, it may be that the gonoplac in bees represents a composite structure of both an outgrowth of the second gonocoxa and an apical gonostylus. An additional component of the debate over terminology is that the term gonostylus implies the homology of the male and female genital parts bearing this name, which is supported by studies of gynandromorphic bees (Michener, 1944). Further study of this structure is needed to identify its homologs in the other insect orders and between the sexes, should they exist.

The sting is composed of three interlocking entities: a dorsal *second gonapophysis* (formed of two fused gonapophyses), and two ventral, unfused *first gonapophyses* (Fig. 1). Each first gonapophysis is equipped with a dorsal valve which, in bees, serves to force venom from the venom gland outward through a channel formed by the interlocking gonapophyses (Snodgrass, 1956). The first and second gonapophyses are anteriorly produced into slender rami, which articulate with the gonangulum and second gonocoxa, respectively. Finally, the second gonapophysis dorsally articulates with the *furcula*, which is a long, posteriorly bifid sclerite.

Male Internal Sclerites

As in other bees, the seventh and eighth sterna of males are highly reduced and internalized in nomadines. A *distal process* is formed on both the S7 and S8 of some Nomadinae, including Epeolini (Figs. 16, 17, and 54–127). On the S7, the apical margin of the distal process is sometimes medially or sublaterally emarginate. In some epeolines, the apical margin is laterally extended into lobes. The presence of these emarginations and lobes, and their relative sizes, are diagnostic characters for separating males of the various epeoline genera, including *Epeolus* from *Triepeolus* (see Key to Genera, below).

STUDIES OF EPEOLINI: PHYLOGENETICS

METHODS

Thirty-seven taxa, including five outgroup taxa, were used in this study (Table 3). The species used as outgroup taxa belong to those tribes identified by Roig-Alsina (1991) as belonging to the lineage characterized by the "nomadine-type S6," excluding Townsendiellini. When possible, an attempt was made to choose a species belonging to a basal genus within each of the outgroup tribes, and additional preference was given to New World species, given the preponderance of epeoline genera from the Western Hemisphere. Specifically, *Brachynomada* sensu stricto is a South American subgenus, *Holcopasites* is the only New World genus of Ammobatoidini, and *Hexepeolus rhodogyne*, the only currently recognized species of Hexepeolini, is known from California and Arizona, USA. *Nomada pampicola* belongs to the *vegana* group of Alexander (1994), as well as to the genus *Hypochrotaenia* recognized by Snelling (1986). Michener (2000) hypothesized that the *vegana* group is basal within *Nomada*, due to the fact that this Neotropical group parasitizes a more closely related group (i.e., *Exomalopsini*) than do other groups of *Nomada* (although this hypothesis is somewhat controversial and was not supported by the phylogenetic study undertaken by Alexander, 1994). Unfortunately, material of the Nearctic genera *Rhopalolemma* and *Neopasites* was scarce; instead, the Palearctic genus *Biastes* was used as an exemplar for Biastini.

An attempt was made to include a morphologically and geographically diverse group of exemplar species for each of the recognized genera and subgenera of Epeolini. Exemplar species of *Doeringiella* were chosen to represent different clades in the phylogeny for the group presented by Roig-Alsina (1989). A minimum of two females and two males were examined for each taxon, with the exception of *Rhogepeolus emarginatus*, for which only one male and female were available.

Many of the characters used in the present phylogenetic analyses were taken or modified from characters discussed by Moure (1955), Roig-Alsina (1989, 1991, 2003), Alexander (1990), and Michener (2000). An annotated list of the 102 characters used in the phylogenetic reconstructions can be found in Appendix 2. The matrix of character codings is located in Appendix 3. Forty-four of the characters are multistate. Characters not applicable to certain taxa are coded as "-"; there are no missing data. All characters are unweighted and all but 10 are nonadditive. The additive characters are 2, 11, 13, 18, 23, 24, 50, 59, 75, and 98, and were selected based on the ability to identify a logical evolutionary sequence for the character states (e.g., a maxillary palpus might logically evolve from containing six palpal segments to five palpal segments before evolving to contain fewer segments.) The plesiomorphic state was not identified a priori and thus character states numbered zero are not implied to be plesiomorphic.

Table 3. Taxa included in the phylogenetic analyses, with locality data associated with examined specimens in parenthesis following names. Footnotes 1–4 give references to studies that support the sister-group relationship of these taxa to the tribe Epeolini.

Outgroup taxa

AMMOBATOIDINI:[1] *Holcopasites calliopsidis* (Linsley) (midwestern USA)
BIASTINI: *Biastes brevicornis* (Panzer) (Slovak Republic)
BRACHYNOMADINI:[2] *B*. (*Brachynomada*) *scotti* Rozen (Peru)
HEXEPEOLINI:[3] *Hexepeolus rhodogyne* Linsley and Michener (southwestern USA)
NOMADINI:[4] *Nomada pampicola* Holmberg (Argentina)

Ingroup taxa: Epeolini

DOERINGIELLA: *Doeringiella*. *bizonata* Holmberg (Argentina), *D*. *cingillata* Moure (Brazil), *D*. *crassicornis* (Friese) (Argentina), *D*. *crinita* Roig-Alsina (Argentina), *D*. *holmbergi* (Schrottky) (Argentina)

EPEOLUS: *Epeolus bifasciatus* Cresson[5] (Kansas, USA), *E*. *compactus* Cresson (Mexico), *E*. *cruciger* (Panzer) (Slovak Republic), *E*. *lectoides* Robertson (New York, USA), *E*. *mesillae* (Cockerell) (southwestern USA), *E*. *natalensis* Smith (South Africa), *E*. *schummeli* Schilling (Slovac Republic), *E*. *tarsalis rozenburgensis* van Lith (Netherlands), *E*. *variolosus* Holmberg[5] (Argentina)

ODYNEROPSIS:[6] *O*. (*Odyneropsis*) *armata* (Friese) (Argentina, Brazil), *O*. (*Parammobates*) *batesi* Cockerell[7] (Panama)

PSEUDEPEOLUS:[8] *Pseudepeolus fasciatus* Holmberg (Argentina, Brazil)

RHINEPEOLUS: *Rhinepeolus rufiventris* Moure (Argentina)

RHOGEPEOLUS:[9] *Rhogepeolus bigibbosus* Moure (Argentina), *R*. *emarginatus* (Moure) (Brazil)

THALESTRIA: *Thalestria spinosa* (Fabricius) (Bolivia, Brazil)

TRIEPEOLUS: *Triepeolus ancoratus* Cockerell (California, USA), *T*. *distinctus* (Cresson) (Arizona, USA), *T*. *epeolurus* Rightmyer (central, southern Mexico), *T*. *heterurus* (Cockerell and Sandhouse) (California, USA), *T*. *kathrynae* Rozen (Mexico), *T*. *lunatus* (Say) (Kansas, New Jersey; USA), *T*. *osiriformis* (Schrottky) (Brazil), *T*. *quadrifasciatus* (Say) (Texas, USA), *T*. *tristis* (Smith) (Austria, Italy, Slovak Republic), *T*. *ventralis* (Meade-Waldo) (China, Japan), *T*. *vicinus* (Cresson) (Cuba)

[1] Rozen, 1996 [adult and larval characters].
[2] Roig-Alsina, 1991 [adult characters, primarily female S6]; Roig-Alsina and Michener, 1993 [adult and larval characters]; Alexander, 1996 [adult characters].
[3] Alexander, 1990 [adult characters, excluding female S6].
[4] Rozen et al., 1997 [larval characters].
[5] These species of *Epeolus* belong to the subgenus *Trophocleptria* of Michener's (2000) classification.
[6] The lectotype of *Parammobates brasiliensis* Friese, type species of *Parammobates*, was also examined.
[7] Based on the species description, it is likely that this species is synonymous with *Odyneropsis columbiana* Schrottky; however, only the holotypes for *Odyneropsis* (*Parammobates*) *batesi* (type locality: Ega, Brazil) and its subspecies *Odyneropsis* (*Parammobates*) *batesi veseyi* Cockerell have been examined. I have also examined material of *O*. (*P*.) *batesi* from Ecuador in the collection of Donald Baker. *Odyneropsis columbiana* is known from Colombia, while *O*. (*P*.) *batesi veseyi* is known from Trinidad.
[8] A male specimen of *Pseudepeolus angustata* (Moure) was also examined.
[9] Specimens of *Rhogepeolus plumbeus* (Ducke) (Brazil) and *Rhogepeolus rozenorum* Rightmyer (Peru) were also examined.

The matrix was constructed in WinClada, version 1.00.08 (Nixon 2002). The phylogeny was created in NONA (Goloboff 1993) using an unconstrained heuristic search [Multiple TBR+TBR ($mult^{x}max^{x}$) search strategy]. The search parameters were 10,000,000 maximum trees to keep, 1000 replications, 1 starting tree per replication, and 0 random time.

Four phylogenetic analyses are presented. The first used all of the taxa listed in Table 3 and characters listed in Appendix 1. The second, third, and fourth analyses were restricted to only those taxa listed under Thalestriina in Table 1, with the addition of different outgroup taxa. In the second analysis, *Epeolus natalensis* was used as the outgroup based on its phylogenetic position in *Epeolus* (herein resolved as sister to the rest of *Epeolus* in the first phylogenetic analysis). All *Epeolus* species listed in Table 3 except for *Epeolus bifasciatus* and *Epeolus variolosus* (i.e., *Trophocleptria* species sensu Michener, 2000) were used as the outgroup in the third analysis. The fourth analysis included all *Epeolus* species listed in Table 3. With the taxa thus restricted, uninformative characters were deactivated in WinClada. In the end, the second phylogenetic analysis employed 20 taxa and 41 characters, seven of which were additive. The third had 26 taxa and 66 characters, 10 of which were additive; the fourth had 28 taxa and 69 characters, 10 of which were additive. The analysis of these restricted data sets then proceeded as described for the first.

The genera and subtribes recognized herein (under Systematics, below), are diagnosed primarily on the basis of characters used in the phylogenetic

analyses. These characters are followed by a number (the character) and a number in parentheses (the character-state), which correspond to numbers in the character matrix found in Appendix 2. Other diagnostic characters are mentioned that were not included in the phylogenetic analyses; these do not have associated character and character-state numbers.

Results

In the phylogenetic analysis of all Epeolini, a heuristic search found 396 equally parsimonious trees (L = 383, CI = 43, RI = 74). The strict consensus of those trees (Figs. 20–21; L = 404, CI = 41, RI = 71) caused the collapse of 11 nodes. The phylogenetic relationships resolved by this analysis are discussed under Systematics (below).

The three restricted analyses of Thalestriina were highly affected by outgroup choice and produced incongruous topologies. The analysis that employed *Epeolus natalensis* as the outgroup produced 90 equally parsimonious trees (L = 125, CI = 46, RI = 67). The strict consensus of those trees (Fig. 22a; L = 144, CI = 40, RI = 57) caused the collapse of 10 nodes. As in the phylogenetic analysis of all Epeolini, Old World and New World *Triepeolus* form a monophyletic group. Unlike the first analysis, *Thalestria* is sister to *Doeringiella*. The analysis that employed all *Epeolus* except those included in *Trophocleptria* (sensu Michener, 2000; see Table 3), produced 70 equally parsimonious trees (L = 191, CI = 47, RI = 71). The strict consensus caused 7 nodes to collapse (Fig. 22b;

L = 203, CI = 44, RI = 71). *Thalestria* is again sister to *Doeringiella*; however the two are sister to New World *Triepeolus*. The two Old World *Triepeolus* species form a clade that, in turn, forms an intuitively unlikely pairing with *Rhinepeolus* and *Pseudepeolus*. Finally, 585 equally parsimonious trees were found in the analysis that employed all *Epeolus* species listed in Table 3 as the outgroup to Thalestriina (L = 208, CI = 47, RI = 76). The strict consensus of these trees collapsed 19 nodes, producing an almost complete polytomy (L = 266, CI = 36, RI = 63). The only resolved clade was a monophyletic *Doeringiella*; no *Triepeolus* species grouped together, and none of the other taxa (each represented by only one species) formed sister-group pairings.

Due to these results, no attempt is made herein to draw conclusions about the relationships among the thalestriine genera. However, pertinent characters that suggest various relationships among the genera are discussed below.

SYSTEMATICS

TRIBE EPEOLINI ROBERTSON

Diagnosis.—Epeolines are characterized by the presence of the following synapomorphies: the two apical or subapical tubercles on the labrum, 4(1) (Figs. 34, 35, and 37; not considered homologous with the apical fringe of irregular tubercles in *Nomada*); the presence of a subapical mandibular tooth formed by the trimmal extension, 6(1) (lost in Thalestriina); the lateroclypeal carina, which forms an almost continuous carina with the paraocular carina, 10(2) (Fig. 39); the dorsal surface of the pronotum, which is convex along the anterior margin, 22(1) [reversed in *Epeolus* (*Trophocleptria*), sensu Michener, 2000]; the axillar spines, which are sometimes very small, 32(1); the roughly quadrate procoxa and widely separated trochanters, 41(1); the elongate and broadly trough-shaped female S5, 66(1); and the inner, medial projection of the penis valve, 100(1) (Figs. 128A and 131–138). The tribe is also characterized by the sclerotized galea, 1(1) (also in *Hexepeolus*), and the patch of dense setae on the anterior margin of the outer mesotibia, 43(1) (Fig. 172; also in *Hexepeolus* and *Nomada*, although the lack of these setae in *Holcopasites*, *Biastes*, and *Brachynomada* may be linked to the smaller size of those bees). Additionally, according to Roig-Alsina and Michener (1993), epeolines are characterized by the shallow postoccipital pouch below the foramen magnum and several characters of the mouthparts: the absence of a glossal rod, the relatively wide, internal sclerotized surface of the galeal blade, the absence of a longitudinal row of bristles on the anterior internal surface of the

maxillary galea, and the membranous inner margin of the first labial palpal segment.

Comments.—The presence of only two maxillary palpal segments (the distal palpal segment short or elongate), 2(1,2), was resolved as the plesiomorphic condition for the tribe. This seems less likely than Alexander's (1990) finding that three maxillary palpal segments is plesiomorphic, since the loss may be more likely than the gain of a segment. However, it may be that considerable sub-segmentation or fusion between segments has occurred, given the observation of three small segments on one side and one small segment and one elongate segment on either side of the same individual of some taxa. The presence of a digitiform appendage on the basal apodeme of the female S6, 79(1), was also resolved as plesiomorphic to Epeolini.

SUBTRIBE ODYNEROPSINA HANDLIRSCH

Odyneropsini Handlirsch 1925: 821. Type genus: *Odyneropsis* Schrottky 1902.

Diagnosis.—This subtribe consists of bees that resemble polistine wasps and lack the bands of appressed setae that characterize most epeolines. Characters supporting this clade are the relatively long pterostigma, 35(2) (Fig. 51); the globular, deeply rugoso-striate setae on the pseudopygidial area, 53(1) (Fig. 180B); and the long, rounded lateral apodemes of the male S8, 90(3) (Figs. 98 and 99). The subtribe is also characterized by the median clypeal carina, 9(1); the relatively short F1 (less than or equal to 0.75 F2), 11(0); the antennal pedicel

of males, which are set into the apex of the scape, 12(0); the interocellar distance, which approximately equals the width of the lateral ocellus, 18(0); and the absence of thick, spine-like setae on the posterior-facing surface of the mesotibia, 44(0).

Comments.—This is the basalmost subtribe within Epeolini.

GENUS *ODYNEROPSIS* SCHROTTKY

Diagnosis.—See Odyneropsina (above).

Comments.—The similarity of certain characters of *Odyneropsis* and *Rhogepeolus*, especially the male genitalia and the female pseudopygidial area and S6, has been noticed by several authors (e.g., Moure 1955, Roig-Alsina 1996). Alexander's (1990) phylogeny, which excluded characters of the female S6, resolved *Odyneropsis* and *Rhogepeolus* as a clade. Michener (2000) hypothesized that *Odyneropsis* might be derived from a *Rhogepeolus*-like ancestor. Indeed, there are several characters that would suggest a sister-group relationship between *Odyneropsis* and *Rhogepeolus*, but which may simply be the plesiomorphic condition for the tribe as a whole (as the present phylogeny would indicate). They include the elongate sclerotized disk of the female S6, 68(0), with the digitiform appendage of the basal apodeme attached sub-basally, widely mesal to the main body of the basal apodeme, 80(0) (Figs. 11 and 12); the dense regions of branched setae on the lateral margins of the male S7, 87(2) (Figs. 64–67; minute branching not indicated for *Odyneropsis*); and the dorsal connecting

bridge of the penis valves, which is expanded into a spatha, 96(1). The medioapical slit of the pseudopygidial area, 51(1) (not always present in *Odyneropsis*; Figs. 179A and 181), is an unusual character found in these genera and might represent a true synapomorphy, although it is here resolved as convergent (a finding supported by the presence of a similar medioapical slit the Caribbean thalestriine species *Triepeolus roni* Genaro).

SUBGENUS *ODYNEROPSIS* SCHROTTKY

Odyneropsis Schrottky 1902: 432. Type species: *Odyneropsis holosericea* Schrottky 1902 [= *Rhathymus armatus* Friese 1900: 65], by original designation.

Diagnosis.—I have not been able to examine all described species of *Odyneropsis*; however, the apparent synapomorphy of this subgenus is the mid-dorsal depression of the female T5, which is entirely or almost entirely bordered by carinae (Fig. 180A). This character appears to be correlated with larger body size (about 14 mm or more). *Odyneropsis* (*Odyneropsis*) *armata* differs from *Odyneropsis* (*Parammobates*) *batesi* by having only one maxillary palpal segment, 2(0) [although Moure (1955) described a female of *O. armata* that had two maxillary palpal segments on one side]; the scutellum, which bears mammiform tubercles, 29(1); the extremely long hind tibia (5 times longer than wide, as opposed to 4 times longer than wide); and the presence of robust setae on the ventral margin of the gonostylus (Fig. 131).

Comments.—Based on personal examination and the original descriptions, the following species are likely to be included in this subgenus: *Odyneropsis apache* Griswold and Parker[3], *O. apicalis* Ducke, *O. armata* Friese, *O. foveata* (Ducke), *O. gertschi* Michener, *O. pallidipennis* Moure, and *O. vespiformis* (Ducke).

SUBGENUS *PARAMMOBATES* FRIESE

Parammobates Friese 1906: 118. Type species: *Parammobates brasiliensis* Friese 1906, monobasic.

Diagnosis.—This subgenus differs from *Odyneropsis* sensu stricto by the smaller size (11 mm or less) and the incomplete mid-dorsal depression of the female T5, which is not anteriorly bordered by a carina or differentiated setae (Fig. 181). *Odyneropsis* (*Parammobates*) *batesi* differs from *O.* (*Odyneropsis*) *armata* by the presence of two maxillary palpal segments, 2(1); the sclerotized plates medially on the penis (Fig. 139); and the dense area of simple setae on the posterolateral angle of the female metatibia (similar to those of Epeolina and Thalestriina), 45(2).

Comments.—*Odyneropsis* (*Parammobates*) *batesi* bears a medioapical slit on the apical margin of the pseudopygidial area; however, this slit is not a consistent feature of *Parammobates* as it is absent in *Odyneropsis*

[3] Based on the original description, this species is likely the same as the putative "new genus" among the material from Arizona observed by Brumley (1965, p. 5–6).

(*Parammobates*) *brasiliensis*, the type species of *Parammobates*. The following species are likely to be included in this subgenus: *Odyneropsis batesi* Cockerell, *O. brasiliensis* (Friese), *O. columbiana* Schrottky, and *O. melancholica* Schrottky.

SUBTRIBE RHOGEPEOLINA RIGHTMYER

Rhogepeolina Rightmyer 2004a: 15. Type genus: *Rhogepeolus* Moure 1955.

Diagnosis.—The only synapomorphy recovered by the present phylogeny to unite this subtribe is the distinct median longitudinal strip of appressed setae between the convexities of the scutellum, 31(1). This character is weakened by the presence of similar but less complete bands in a few species of *Doeringiella* and *Triepeolus*. Nonetheless, a number of characteristics make this group easy to recognize. The pseudopygidial area is particularly distinctive, with a strongly concave apical margin, 50(2), bearing a medioapical slit, 51(1). The lateral margins of this slit and the apical margin of the pseudopygidial area are fringed with relatively long, curved, simple setae (Fig. 179). The pseudopygidial area is located on a posterior facing plane of T5, with short, simple setae that are curved towards the midline. In addition, the female mesotibia and metatibia bear rounded, stout spines along their apical margins, 45(1) (Figs. 172 and 173); the female pygidial plate has a glabrous, median longitudinal ridge, 56(1); and the male S7 is characterized by a dense region of long, branched setae on the lateral margins of the distal process, 87(2) (Figs. 64 and 65).

GENUS *RHOGEPEOLUS* MOURE

Rhogepeolus Moure 1955: 117. Type species: *Rhogepeolus bigibbosus* Moure 1955, by original designation.

Coptepeolus Moure 1955: 120. Type species: *Coptepeolus emarginatus* Moure 1955, by original designation.

Diagnosis.—See Rhogepeolina (above).

Comments.—*Rhogepeolus* contains a spectrum of relatively divergent morphological forms, with *Rhogepeolus emarginatus* and *Rhogepeolus bigibbosus* representing the extremes. The fact that Moure (1955) originally placed these two species in separate genera is indicative of the extent of their differences; however, Roig-Alsina (1996) discovered additional species that caused these morphological differences to intergrade. According to Alexander (1990), the apex of the marginal cell is truncated or oblique in this genus, but I found this difficult to distinguish from the rounded state found in other epeolines. The genus presently consists of five species, all from South America (Roig-Alsina, 1996; Rightmyer, 2003).

RHOGEPEOLINA + (EPEOLINA + THALESTRIINA)

Comments.—Several synapomorphies support the sister-group relationship of Rhogepeolina to all other Epeolini excluding Odyneropsina. The synapomorphies are the contact of both mandibular articulations with the compound eye, 3(0); the ventrally convergent compound eyes of males, 17(0)

(parallel in *Thalestria*); the relatively short second abscissa of hind wing vein M+Cu, 40(1) (relatively long in most *Doeringiella*); the dorsally enlarged bases of the spine-like setae of the metatibia, 46(2) (Fig. 174); the elongate, curved apical setae of the male S4, 64(1) (not elongate in *Thalestria*); and the roughly straight, parallel sided lateral margins of the male S7, 86(0) (rounded in some Thalestriina). These subtribes are also characterized by the forewing vein r-rs, which arises from point distal to the midpoint of the pterostigma, 36(0) (Figs. 52 and 53); the length of all the submarginal cells together, which is distinctly greater than the length of marginal cell, 37(0); and the papilliform setae on the forewing distal to the closed cells 39(1).

EPEOLINA + THALESTRIINA

Comments.—The synapomorphies supporting the sister-group relationship of the subtribes Epeolina and Thalestriina are: the forewing radial cell with the setae primarily restricted to the upper (i.e., costal) half or less of the cell, 34(1) (more or less dense in a minority of taxa); the elongate, curved setae of the male S5, 65(2) (less pronounced in *Pseudepeolus*); the apical, sublateral emarginations of the male S7, 84(1) (Figs. 68–95); and the roughly bar shaped dorsal connecting bridge of the penis valves, 96(3) (triangular in *Thalestria*; reduced in some *Epeolus*). This clade is also characterized by the roughly pentagonal-shaped swelling of the supraclypeal area, 8(2); the absence of the preoccipital carina on the upper corners of the head, 21(3) (Fig. 32); the strongly

sclerotized V or U shape formed by the inner and outer margins of the female S6 near the mediolateral apodeme, 78(1) (Figs. 7, 9, 10, and 13); and the position of the lateral sulcus of the male gonocoxite, which runs obliquely from the base of the gonostylus to a more ventral and basal position on the gonocoxite (see arrow, Fig. 133).

SUBTRIBE EPEOLINA ROBERTSON

Epeolinae Robertson 1903: 284. Type genus: *Epeolus* Latreille 1802.

Diagnosis.—Epeolina can be distinguished from other Epeolini by the following synapomorphies: the dorsal protrusion of the gena, 20(1) [Figs. 41 and 42; enlarged in *Trophocleptria*, sensu Michener, 2000]; the silvery band of apically rounded, flattened setae on the pseudopygidial area, 52(1) (Figs. 190 and 191); the principal setae at the apex of the female S6, which form conical denticles, 70(2) (Fig. 13); the dorsoapical setae on the lateral lobes of the male S7, 89(1) (Figs. 68–76); the single, elongate gonostylus that is angled basally into a lobe, 95(1) (Fig. 129); and the widely divergent lobe on the dorsolateral margin of the penis, 102(1) (Fig. 141) [absent in *Trophocleptria*, sensu Michener, 2000; Fig. 142]. The subtribe is additionally characterized by the relatively long, dorsal surface of the pronotum (about equal to median ocellar diameter), 23(2); and the lack of a median emargination at the apex of the male S7, 83(0). The subtribe can additionally be distinguished from most Thalestriina by the more apical position of the lateral lobes relative to the interlobal area of the male S7, 85(0). Finally,

the presence of any of the following features can serve to differentiate some (but not all) males of *Epeolus* from *Triepeolus*: paramedian bands that converge medially on the scutum; S3, S4, and/or S5 that are strongly medially emarginate and/or have strongly medially-directed apical fringes of setae; and axillar spines that are especially flattened and triangular.

GENUS *EPEOLUS* LATREILLE

Epeolus Latreille 1802: 427. Type species: *Apis variegata* Linnaeus 1758, monobasic.

Trophocleptria Holmberg 1886c: 275. Type species: *Trophocleptria variolosa* Holmberg 1886c, monobasic.

Epeolus (*Diepeolus*) Gribodo 1894: 79. Type species: *Epeolus giannellii* Gribodo 1894, monobasic.

Epeolus (*Monoepeolus*) Gribodo 1894: 80. Type species: *Apis variegata* Linnaeus 1758, by original designation.

Pyrrhomelecta Ashmead 1899: 66. Type species: *Epeolus glabratus* Cresson 1878, by original designation.

Argyroselenis Robertson 1903: 284. Type species: *Triepeolus minimus* Robertson 1902, by original designation.

Oxybiastes Mavromoustakis 1954: 260. Type species: *Oxybiastes bischoffi* Mavromoustakis 1954, by original designation.

Diagnosis.—See Epeolina (above).

Comments.—Diagnostic characteristics of at least some *Epeolus* were discovered by Roig-Alsina and Michener (1993). They include the well developed, fan shaped posterior sheets of the tentorium, the posteriorly curved

pre-episternal internal ridge, and absence of the lower extremity of the metapostnotum.

Michener (2000) recognized *Trophocleptria* as a subgenus of *Epeolus*. *Trophocleptria* is a distinctive group; however, it renders *Epeolus* sensu stricto paraphyletic. A species-level analysis of the entire genus *Epeolus* will likely resolve clades that will allow for the recognition of *Trophocleptria* along with several other new genera or subgenera of *Epeolus*. The monophyly of *Trophocleptria* seems likely to remain stable, given the number of synapomorphies uniting *Epeolus bifasciatus* (a geographical outlier from North America that is generally considered intermediate between *Epeolus* sensu stricto and *Trophocleptria*; Michener, 2000) with *Epeolus variolosus*, including the pronounced dorsal genal protrusion, 20(2), and the waxy, glabrous lobe between the compound eye and lateral ocellus, 19(2) (Fig. 42); the position of the dorsal posterior surface of the pronotum near the dorsal surface of the scutum, 24(0) (Fig. 50); the carinate or flattened projections of the deeply areolate scutellum, 28(1); and the absence of the widely divergent lobe on the dorsolateral margin of the penis that characterizes all other examined *Epeolus*, 102(0).

SUBTRIBE THALESTRIINA RIGHTMYER

Thalestriina Rightmyer 2004a: 17. Type Genus: *Thalestria* Smith 1854.

Diagnosis.—The subtribe Thalestriina is primarily characterized by the female S6: the principal setae are elongate, pointed, and hooked, 70(3); the

sclerotized disk is reduced (sometimes extremely reduced to a rod-like connection between the apical processes of the S6), 68(1); and the mediolateral apodeme is relatively basal on the S6 (i.e., the length of the female S6 basal to the mediolateral apodeme equals 30–40% of the total S6 length or less), 75(1) (Figs. 7, 9, and 10). Additionally, the female S6 lacks marginal setae medially between the apical processes, 72(1), and the apical process has a flat, stake-like, usually three pronged apical plate dividing the principal setae from the dorsoapical setae, 73(2). An additional synapomorphy is the dorsobasal lobe of the penis valve, which conspicuously covers the basolateral margins of the penis, 98(2). Other characterizations of the subtribe are the absence of a distinct subapical mandibular tooth, 6(0); the apodemal region of the female T7, which roughly forms a right angle, 61(1) (Figs. 160–165); and the cross bar that extends from the anterior ridge of the female T8, 62(1) (Figs. 150 and151). All Thalestriina except *Thalestria* are additionally characterized by the lateral, scroll-like processes found on the apical ventral surface of the female pygidial plate, 57(5) (Fig. 178)

GENUS *THALESTRIA* SMITH

Thalestria Smith 1854: 283. Type species: *Thalestria smaragdina* Smith 1854 [= *Euglossa spinosa* Fabricius 1804:362], monobasic.

Diagnosis.—*Thalestria* is immediately distinguishable from all other epeolines by the bright metallic blue and green scales that clothe the majority of the body. The pterostigma is relatively small (1.5 times the prestigma length).

35(0) (Fig. 52); the apical ventral surface of female pygidial plate, in posterior view, forms one median, rounded process, 57(1) (Fig. 175); the lateral process of the female T7 is dramatically elongate, 59(2) (Fig. 162); the mediolateral apodeme is extremely basal in its location along the lateral margin of the female S6 (i.e., the length of the female S6 basal to the mediolateral apodeme is only 15% of total S6 length), 75(0) (Fig. 10); and the dorsal connecting bridge of penis valves is roughly triangular, 96(3). Additional distinctive traits of the genus are the position of the preoccipital carina much below the ocelli on the posterior surface of the head; the two plate-like integumental structures that meet at an angle along an impressed line on the vertex behind the median ocellus; and the relatively large eyes (especially of males). *Thalestria* is additionally characterized by the parallel compound eyes of the males, 17(1); the relatively small interocellar distance, 18(0); the continuous preoccipital carina, which lacks angles at the upper corners of the head, 21(1); the enlarged mammiform tubercles on the scutellum, 29(2); the unmodified (i.e., not dorsally enlarged) bases of the metatibial spine-like setae, 46(1); the restriction of the appressed setae to small spots on the metasoma, 48(1); the lack of elongate or curved setae at the apex of the male S4, 64(0); the straight, bar shaped disk that is roughly perpendicular to the inner margins of the apical processes of the female S6, 69(3); the lack of a digitiform appendage on the basal apodeme of the female S6, 79(0); and the male S7, which has the lateral margins of the distal plate above the interlobal area, 85(0).

Comments.—The relationship of *Thalestria* to the other genera of Thalestriina is poorly resolved in the phylogenetic analysis of Epeolini (Fig. 21b). Two of the restricted phylogenies of Thalestriina (Fig. 22) placed *Thalestria* as the sister taxon to *Doeringiella* based on the prominent depression of the frons behind the scape, 15(1); the relatively short dorsal surface of the pronotum (much less than an ocellar diameter), 23(1); and the long setae on underside of male mesofemur, 42(1). They also share the arching anterior surface of the scutum, 24(2).

Alternatively, *Thalestria* and *Rhinepeolus* share the continuous preoccipital carina that does not form angles at the upper corners of the head, 21(1); the enlarged mammiform tubercles of the scutellum, 29(2); and the lack of a digitiform appendage on the basal apodeme of the female S6, 79(0).

Thalestria shares with New World *Triepeolus* the short female F1 relative to F2, 11(0), as well as the absence of elongate, curved setae at the apex of the male S3 (in most species), 63(0). The straight, bar shaped disk that is roughly perpendicular to the inner margins of the apical processes of the female S6, 69(3), is shared by *Thalestria* and some New World *Triepeolus*, suggesting the possibility that *Thalestria* is derived from within *Triepeolus*. The extremely elongate lateral process of the female T7, 59(2), would similarly seem to be a continued derivation of the elongate lateral process found in *Doeringiella* and New World *Triepeolus* (except *Triepeolus epeolurus*), 59(1). New World *Triepeolus* (except *T. epeolurus*) also share with *Thalestria* the complete lack of a

basitibial plate, 47(0) (a partial basitibial plate being found in Old World *Triepeolus*, *T. epeolurus*, *Rhinepeolus*, and most *Pseudepeolus*, and a complete basitibial plate being found in *Doeringiella*, *Pseudepeolus willinki*, and *Pseudepeolus carinata*, according to Roig-Alsina, 2003).

Support for the basal position of *Thalestria* within Thalestriina may come from Alexander's (1990) coding that it shares with *Epeolus*, *Rhogepeolus*, and *Odyneropsis* the presence of an inner dorsal carina or lamella on the metacoxa, which is lacking in *Triepeolus*, *Doeringiella*, and *Rhinepeolus*. While there is a tendency for these latter groups to have a weaker, shorter carina than other members of the Epeolini, the character is not consistent. For example, some *Triepeolus* (e.g., *Triepeolus ancoratus*) possess a strong inner dorsal lamella on the metacoxa.

GENUS *DOERINGIELLA* HOLMBERG

Doeringiella Holmberg 1886a: 151. Type species: *Doeringiella bizonata* Holmberg 1886a, monobasic.

Doeringiella (*Orfilana*) Moure 1954: 266. Type species: *Doeringiella variegata* Holmberg 1886c [= *Epeolus homlbergi* Schrottky 1913: 265], by original designation.

Diagnosis.—The monophyly of *Doeringiella* is supported by the male and female scape, which, when not swollen, bears a sub-basal angle on the plical surface, 14(1), and the highly recurved, scroll-like articulating surfaces of the penis valve, 99(1). Both characters are further discussed and clarified by Roig-

Alsina (1989). The genus is additionally characterized by the depressed regions of the frons behind the scape, 15(1) (Fig. 167); the relatively long scape (i.e., greater than two times the width of the scape), 13(3); the weak biconvexities of the scutellum, 27(1); the long setae on the underside of the male mesofemur (not in *Doeringiella chacoensis*; Roig-Alsina, 1989), 42(1); the completely bordered basitibial plate (both sexes), 47(2); the medially emarginate sides of the medioapical process of the male S8, 92(1) (Figs. 114–118; however, they are not emarginate in *Doeringiella arechavaletai*, *D. paranensis*, *D. gigas*, and *D. cochabambina*, according to Roig-Alsina, 1989); and the distinctly emarginate ventral margin of the male gonocoxite, 94(1) (Fig. 136). Furthermore, there is a tendency for a narrowing of sclerotized areas basally on the penis valves (Fig. 145). Most conspicuously, males of several species of this genus bear dramatically swollen scapes.

Comments.—*Doeringiella*, *Triepeolus*, and *Pseudepeolus* were given subgeneric status under the genus *Doeringiella* by Michener (2000). This decision was largely due to similar characteristics of the male genitalia, especially the emarginate male gonocoxite, 94(1), and the elongate, bar shaped dorsal connecting bridge of the penis valves, 96(3). Support for this classification is weakened by the findings that the bar shaped dorsal connecting bridge of *Pseudepeolus* is similar to that found in *Rhinepeolus*, and that the emarginate male gonocoxite is not possessed by Old World *Triepeolus*. Nonetheless, species of *Doeringiella* share the emarginate ventral margin of the male gonocoxite with

Pseudepeolus and New World *Triepeolus*; they also share the elongate lateral process of the female T7 with all New World *Triepeolus* except *Triepeolus epeolurus*. Alternatively, *Doeringiella* shares with Old World *Triepeolus* and *Rhinepeolus* the presence of elongate, curved setae on the apical margin of the male S3, 63(2); it shares with *Rhinepeolus* and *T. epeolurus* the relatively long scape, 13(3).

The relationships of the *Doeringiella* species resolved by the present phylogenetic study do not correspond well with those recovered by Roig-Alsina (1989) or Compagnucci and Roig-Alsina (2003), whose phylogenies were specifically constructed to address the internal relationships of that genus. The incongruence might be explained by the fact that the present study did not include all species of *Doeringiella*, nor did it include all pertinent characters related to the genus.

GENUS *RHINEPEOLUS* MOURE

Rhinepeolus Moure 1955: 115. Type species: *Epeolus rufiventris* Friese 1908, by original designation.

Diagnosis.—*Rhinepeolus* is most readily differentiated from all other Epeolini by the form of the female pseudopygidial area, which has a median, longitudinal region of stout, simple setae that give the impression of a furrow (Fig. 183). The mesocoxa of this genus has a distinct, prominent carina between the anterior and posterior coxotrochanteral articulation; also, the female T6 bears

a flange lateral to the pygidial plate that is absent in all other Epeolini. It is distinct from other Thalestriina by the exceptionally bulbous protrusion of the supraclypeal area, 8(3), which bears a weakly carinate frontal line, 7(0) (Fig. 168); the presence of a median longitudinal band of appressed setae on the scutum, 25(1); the absence of biconvexity, 27(0), coupled with the presence of enlarged mammiform tubercles on the scutellum, 29(2) (such tubercles also found in *Thalestria*); and the sparsely scattered setae on the forewing radial cell, 34(2). The genus is additionally characterized by the concave apical margin of the labrum, 5(1); the relatively long, slender scape, 13(3); the continuous, smoothly rounded preoccipital carina, 21(1); the presence of a basitibial plate that is incompletely bordered by a carina, 47(1); the poorly defined metapostnotum; the relatively long second abscissa of the hind wing vein M+Cu (over twice as long as cu-a), 40(0); the convex apical margin of the pseudopygidial area, 50(0); the apical, ventrally directed lip of the female S5, 67(1); the absence of a distinctly sclerotized connection between the inner and outer margins of the female S6 near the mediolateral apodeme, 78(0); and the lack of a digitiform appendage on the basal apodeme of the female S6, 79(0).

Comments.—A sister-group relationship of *Rhinepeolus* to *Pseudepeolus* was recovered in the phylogenetic analysis of all Epeolini, supported only by the appearance of the inner basal margin of the female S6, which does not conspicuously meet the outer margin near the mediolateral apodeme, 78(0). *Rhinepeolus* shares the apical, ventrally directed lip of the female S5 with several

species of *Triepeolus* and *Doeringiella*, 67(1). Other characters that could potentially support the relationship of *Rhinepeolus* with other thalestriine genera are discussed in the Comments sections of *Thalestria* and *Doeringiella*.

GENUS *PSEUDEPEOLUS* HOLMBERG

Pseudepeolus Holmberg 1886c: 284. Type species: *Pseudepeolus fasciatus* Holmberg 1886c, monobasic.

Pseudopeolus Ashmead 1899: 80. *Lapsus calami*.

Doeringiella (*Stenothisa*) Moure 1954: 277. Type species: *Doeringiella angustata* Moure 1954, by original designation.

Diagnosis.—Superficially, species of *Pseudepeolus* most resemble *Doeringiella*, especially in the overall appearance of the pseudopygidial area. Unfortunately, I was unable to study specimens of basal *Pseudepeolus* species (e.g., *Pseudepeolus willinki* or *P. carinata*), as resolved by Roig-Alsina (2003). Based on observations of *Pseudepeolus fasciatus* (and, to a more limited degree, a male specimen of *Pseudepeolus angustata*), the genus can be distinguished from other Thalestriina by the relatively short scape (about 1.5 longer than width), 13(1), which is flattened in the male, and the dense setae on the forewing radial cell, 34(0). *Pseudepeolus* is characterized by the apical margin of labrum, which bears a process, 5(2) (Fig. 37; considered to be a third apical tubercle by Roig-Alsina, 2003); the relatively short female F1 compared to F2, 11(0); the presence of a basitibial plate that is incompletely bordered by a carina, 47(1) (entirely

bordered in *P. willinki* and *P. carinata*; Roig-Alsina, 2003); the straight, elongate setae at the apex of the male S3, 63(1), and S5, 65(1) (apical fringe of S3 more developed in *P. willinki*; Roig-Alsina, 2003); the male S7 with rounded lateral margins of the distal plate, 86(3) (Fig. 79); and the emarginate ventral margin of the male gonocoxite, 94(1) (Fig. 137). While the pseudopygidial area of this genus superficially resembles that of *Doeringiella*, scanning electron microscopy has revealed a number of setal types that are presently unique to *P. fasciatus*, if not all *Pseudepeolus*. Especially striking are the sharply pointed setae that fringe the apical margin of the pseudopygidial area (Fig. 184B).

Comments.—Roig-Alsina (2003) used the dorsal separation of the preoccipital carina from the compound eye margin as a synapomorphy for *Pseudepeolus*; however, I found this character difficult to use since the preoccipital carina disappears at the upper corner of the head in many Thalestriina. For discussion of the characters that might support a relationship of *Pseudepeolus* with other thalestriine genera, refer to the Comments sections of *Thalestria*, *Doeringiella*, and *Rhinepeolus*.

GENUS *TRIEPEOLUS* ROBERTSON

Triepeolus Robertson 1901: 231. Type species: *Epeolus concavus* Cresson 1878, by original designation.

Triepeolus (*Synepeolus*) Cockerell 1921: 6. Type species: *Triepeolus insolitus* Cockerell 1921, monobasic.

Triepeorus Tadauchi and Schwarz 1999: 47. *Lapsus calami*.

Tniepeolus Cockerell 1916b: 392. *Lapsus calami*.

Diagnosis.—The dearth of synapomorphic characters supporting the monophyly of *Triepeolus* is indicative of the range of morphological variation within this group. The most consistent character separating members of *Triepeolus* from other Thalestriina would seem to be the length of the paramedian bands of appressed setae (extending roughly to the middle of the scutum), 26(2); however, these bands are not present on all *Triepeolus* species [e.g., *Triepeolus mexicanus* (Cresson)]. The genus is additionally characterized by the presence of three or two maxillary palpal segments (with the distal segment elongate, except in *Triepeolus osiriformis* where it is small), 2(2,3); the antennal pedicel of males, which is set into the apex of the scape, 12(0) (more fully exposed in *Triepeolus epeolurus*); and the distinct pocket of setae found in the apical emargination near the lateral lobe on the ventral surface of the male S7, 88(1) (Figs. 86–95; pocket of setae not distinct in *Triepeolus tristis*). Additionally, the dorsal surfaces of the penis valves tend to be more sclerotized in *Triepeolus* than in other epeolines (Fig. 146). Within Epeolini, the restriction of the preoccipital carina to the gena, 21(4) (Fig. 33), and the apical, downturned plane of male pygidial plate, 58(1) (Fig. 19), are characters unique to some (but not all) species of *Triepeolus*.

The New World species of *Triepeolus* form a monophyletic group, segregated from the Old World species based on the following characters: the presence of the preoccipital carina only on the gena, 21(4) (also on the dorsal

edge of head in *Triepeolus distinctus* and *Triepeolus epeolurus*); the relatively short female F1 relative to F2, 11(0); the absence of the basitibial plate, 47(0) (partially present in *T. epeolurus*); the elongate lateral process of the female T7, 59(1) (not elongate in *T. epeolurus*); the absence of elongate or curved setae on the apex of the male S3, 63(0); and the emarginate ventral margin of the male gonocoxite, 94(1).

Comments.—Although the number of maxillary palpal segments is widely recognized to be unstable and therefore of relatively little use in phylogenetic reconstruction, *Triepeolus* species (except for *Triepeolus osiriformis*) tend to have either three or two maxillary palpal segments (if only two segments, then the distal segment is elongate). This is unlike most other Thalestriina, which tend to have two, relatively small and ovate maxillary palpal segments.

A diverse array of morphological variation is present among species of *Triepeolus*, especially in the overall shape of the pseudopygidial area and types of setae present on that structure, the overall shape and the presence or absence of a basal ridge on the male pygidial plate, and the shape of the female S5 and S6. The diversity of pseudopygidial forms within *Triepeolus* is particularly pronounced (Figs. 186–189). Many species of *Triepeolus* have at least some setae on the pseudopygidial area that reflect a dark, golden color.

KEY TO THE GENERA OF EPEOLINI

1. Body largely covered by bright metallic blue or green scale-like setae ..... *Thalestria*

— Body lacking bright metallic blue or green scale-like setae 2

2(1). Inner margins of compound eyes roughly parallel (Fig. 166); metasoma lacking apical bands of pale setae; pterostigma relatively long (5 times longer than prestigma; Fig. 51); mesotibia lacking spine-like setae on posterior surface ..... *Odyneropsis*

— Inner margins of compound eyes converging below (Figs. 167–169); metasoma rarely lacking apical bands of pale setae; pterostigma relatively short (about 3 times longer than prestigma; Fig. 53); mesotibia with spine-like setae on posterior surface (Fig. 172) 3

3(2). Scutellum with median longitudinal strip of appressed setae present between convexities; pseudopygidial area with apical margin strongly concave, bearing medioapical slit that is fringed on posterior margin with relatively long, curved, simple setae (Fig. 179); F1 relatively long (greater than length of F2) ..... *Rhogepeolus*

— Scutellum rarely with distinct median longitudinal strip of appressed setae; pseudopygidial area variable but rarely strongly concave and not bearing medioapical slit (except in *Triepeolus roni* Genaro); length of F1 variable, but not greater than length of F2 4

4(3). Males 5

— Females 9

5(4). Scape dramatically swollen or forming sub-basal angle on plical surface; metafemur with elongate setae on undersurface (rarely lacking); S3 with elongate, curled setae on apical margin [preoccipital carina complete or absent at upper corners of head (Figs. 31 and 32); basitibial plate completely bordered by carina] ..... *Doeringiella*

— Scape variable but not swollen, not forming sub-basal angle on plical surface; metafemur very rarely with elongate setae on undersurface; S3 with apical setae variable, rarely curled 6

6(5). Supraclypeal area produced into bulbous protrusion with weak median carina (Fig. 168); preoccipital carina continuous on head (Fig. 30); scutum with median longitudinal band of appressed setae (sometimes faint); scutellum relatively flat, bearing two mammiform tubercles; second abscissa of hind wing vein M+Cu over twice as long as cu-a .... *Rhinepeolus*

— Supraclypeal area and median carina variable, but rarely produced into bulbous protrusion; preoccipital carina absent at least on upper corners of head (Figs. 32 and 33); scutum usually lacking median longitudinal band of appressed setae (paramedian bands can be present); scutellum variable but not bearing mammiform tubercles; second abscissa of hind wing vein M+Cu usually less than twice as long as cu-a 7

7(6). Scape length ca. 1.5 times width, flattened on condylar surface; preoccipital carina absent on upper corners of head (Fig. 32); S3 with straight, elongate setae on apical margin; basitibial plate incompletely or rarely completely bordered by carinae ..... *Pseudepeolus*

— Scape length variable, not flattened on condylar surface; preoccipital carina absent on at least upper corners of head, often also on dorsal margin of head; S3 with setae usually undifferentiated on apical margin, rarely elongate or curled; basitibial plate absent or rarely incompletely bordered by carinae 8

8(7). Mandible lacking distinct preapical tooth; pygidial plate usually with median constriction, often apically differentiated into distinct, down-turned, posterior surface (Fig. 19), or present as an elongate, narrow structure; S7 usually with median emargination on distal margin, with lateral lobes below interlobal area, and apical setae mostly ventral, forming distinct pocket near lateral apical lobe (Figs. 85–95); gonostylus lacking basal lobe (Fig. 128B); penis usually lacking lateral projections (Fig. 146) or sometimes with subapical, lamellate projection; dorsobasal lobe of penis valve covering basolateral margin of penis; antennal pedicel usually set into scape ..... *Triepeolus*

— Mandible usually with preapical tooth (Fig. 39); pygidial plate almost always all in one plane, broadly rounded posteriorly; S7 usually lacking median emargination on distal margin, with lateral lobes above interlobal

area, and with apical setae mostly dorsal, on surface leading from lateral lobe (Figs. 68–76); gonostylus with basal angle or lobe (Fig. 129); penis with widely divergent, fleshy lateral lobe (Fig. 141), or lacking in *Trophocleptria*, sensu Michener, 2000 (Fig. 142); dorsobasal lobe of penis valve not enlarged, not covering basolateral margin of penis; antennal pedicel usually mostly exposed ..... *Epeolus*

9(4). Lateral processes of S6 spatulate, with apical principal setae forming small denticles (Fig. 13); pseudopygidial area forming wide lunule of silvery setae on apical margin; apical ventral surface of pygidial plate with two medial, flattened, rounded processes, sometimes very reduced (Fig. 176) ..... *Epeolus*

— Lateral processes of S6 rod-like, with apical principal setae elongate and hooked (Fig. 7); pseudopygidial area variable, very rarely forming wide lunule of silvery setae on apical margin; apical ventral surface of pygidial plate with lateral, scroll-like processes (Fig. 178) 10

10(9). Supraclypeal area produced into bulbous protrusion with weak median carina (Fig. 168); scutellum relatively flat, bearing two mammiform tubercles; pseudopygidial area with median longitudinal row of dark, stout setae, and with apical margin convex (Fig. 183); preoccipital carina continuous on head (Fig. 30) (second abscissa of the hind wing vein M+Cu over twice as long as cu-a) ..... *Rhinepeolus*

— Supraclypeal area not bulbous, with strong or weak protrusion and carina; scutellum variable but not bearing mammiform tubercles; pseudopygidial area variable but lacking median, longitudinal row of dark, stout setae; preoccipital carina forming angles at upper corners of head or absent on at least dorsal corners of head (Figs. 31–33) 11

11(10). Scape length about twice its width, forming sub-basal angle on plical surface; preoccipital carina complete or absent at upper corners of head (Figs. 31 and 32); F1 and F2 of about same length (basitibial plate completely bordered by carina) ..... *Doeringiella*

— Scape usually only 1.5 times its width, rarely twice, not forming sub-basal angle on plical surface; preoccipital carina absent at upper corners of head or along entire upper border of head (Figs. 32 and 33); F1 usually shorter than F2, rarely the same length 12

12(11). Scutum usually with elongate paramedian bands of pale setae reaching middle; basitibial plate absent or incomplete; preoccipital carina absent on upper corners of head or along entire upper border of head (Figs. 32 and 33); maxillary palpus with two or three segments (Figs. 26–28) .... *Triepeolus*

— Scutum with paramedian bands of pale setae often reduced, usually restricted to anterior fourth; basitibial plate incompletely or rarely completely bordered by carina; preoccipital carina absent at upper corners

of head only (Fig. 32); maxillary palpus usually with two small segments (Fig. 28) ..... *Pseudepeolus*

DISCUSSION

The monophyly of Epeolini and its subtribes, and the phylogenetic relationships of these subtribes to one another, are strongly supported by several synapomorphic characters (Fig. 21a, and comments under the systematic treatments of Epeolini, Odyneropsina, Rhogepeolina, Epeolina, and Thalestriina, above). The monophyly of Epeolini was also supported by shared features of the labrum and spiracles of mature larvae in an analysis prepared by Rozen (1996). *Odyneropsis* is resolved as the basalmost lineage of the tribe, rather than sister to *Rhogepeolus*, as was suggested by some previous workers (see Comments under *Odyneropsis*). *Rhogepeolus* is instead resolved as sister to the rest of Epeolini due to several synapomorphic features of the mandibular articulations, compound eyes, hind wing veins, setae of the metatibia, and male S4 and S7. *Epeolus* and Thalestriina form a clade based on shared features of the male S7, dorsal connecting bridge of the penis valves, and setae on the forewing and male S5.

The phylogeny of the genera within Thalestriina is poorly resolved (Fig. 21), and the restricted phylogenetic analyses of Thalestriina (Fig. 22) produced different topologies than was produced by the analysis of the entire tribe. The only resolved clades within Thalestriina that were moderately robust to outgroup selection were the clades (*Rhinepeolus* + *Pseudepeolus*) and (*Doeringiella* + *Thalestria*). *Rhinepeolus* and *Pseudepeolus* share the trait of not having the inner and outer margins of the female S6 strongly converging near the mediolateral apodeme, as is found in the other genera of Thalestriina (particularly *Triepeolus*

and *Doeringiella*). *Doeringiella* and *Thalestria* share the prominent depression on the frons behind the scape and the long setae on the underside of the male mesofemur (although such setae are also present in basal *Pseudepeolus*, according to Compagnucci and Roig-Alsina, 2003). None of the clades resolved by these analyses have been previously proposed and I do not consider them to be sufficiently supported to merit their recognition in a new classification scheme. Additional study of this subtribe is needed; it would be desirable to add characters from other sources, such as the eggs, larvae, and DNA sequence data. Rozen (1996) found mature larval characters of the mandibles and maxillary palpi that vary within Thalestriina and Epeolini as a whole; unfortunately, the immatures of *Rhinepeolus* and *Pseudepeolus* are still not known, and a more detailed examination of *Doeringiella* larvae is desirable before such an analysis can be undertaken.

The present study was not designed to address which outgroup tribe is sister to Epeolini, and any resolution in topology at this level should be considered tentative. However, *Brachynomada* (tribe Brachynomadini) is resolved as the nearest outgroup to Epeolini based on the presence of a paraocular carina and a distinct distal process on the male S7. A sister-group relationship of Brachynomadini with Epeolini seems intuitively pleasing given the similarity of both the male S7 and S8 (Figs. 55, 60, 64–127). However, the paraocular carina is weaker in *Brachynomada* than in epeolines, and *Brachynomada* differs

strikingly from Epeolini (and other nomadines) by the lack of principal setae on the female S6 (Fig. 5).

Hexepeolus is resolved as sister to *Nomada*, supported by a number of homoplastic characters. Roig-Alsina and Michener (1993) code *Hexepeolus* and some members of *Nomada* as lacking a flabellum, a character which might provide additional support for this relationship. Alternatively, *Hexepeolus* shares with Epeolini a few seemingly strong synapomorphies. They include the sclerotized galea, and according to Alexander (1990), the postgenal bridge of the lower occipital area interrupted by a median longitudinal trough.

Although this study was similarly not designed to resolve the internal relationships of genera, some interesting patterns are worth mentioning. Old World taxa are resolved as basal within *Epeolus*, with the African species, *Epeolus natalensis*, segregated as a lineage basal to the European and New World taxa. This result parallels Alexander's (1994) hypothesis that South African *Nomada* are basal within Nomadini. Additionally, in some most parsimonious trees (not shown), *Epeolus lectoides* is grouped with *Epeolus bifasciatus* and *Epeolus variolosus* based on the apically emarginate sides of the medioapical process of the male S8; also, *E. lectoides* has a shining area in the same position that the other two species bear a waxy protrusion (although the latter condition is shared by several other North American *Epeolus*; Brumley, 1965, and personal observation). However, unlike all other examined *Epeolus* species, *E. lectoides* bears a distinct, sub-basal digitiform appendage on the basal apodeme of the

female S6 (Fig. 8). This feature resembles the Thalestriina-type S6 basal apodemal appendage, and therefore might suggest a less derived position of this species within *Epeolus*.

Old World species of *Triepeolus* were similarly recovered as basal in the present phylogenetic analyses, with *Triepeolus tristis* basal to *Triepeolus ventralis*. An additional clade of *Triepeolus* was unambiguously resolved composed of *Triepeolus ancoratus*, *T. lunatus*, *T. quadrifasciatus*, and *T. vicinus*. This clade is supported by the presence of three maxillary palpal segments, 2(2); the basally tubular and apically spatulate setae of the pseudopygidial area, 55(1) (Fig. 188B); the circular, down-turned distal plane of the male pygidial plate, 58(1) (Fig. 19); the downcurved female S5, 67(1); the straight, bar shaped disk that is roughly perpendicular to the inner margins of the apical processes of the female S6, 69(3) (Fig. 9); and the rounded lateral margins of the distal process of the male S7, 86(3) (Figs. 88, 90, 91, and 94). Many of these characters are homoplastic and it remains to be seen if the clade will be recovered in a more robust analysis of the genus. The internal relationships of *Triepeolus* will be examined in a forthcoming phylogenetic study (Rightmyer, in prep.).

Based on the results of this study, the tribe Epeolini likely originated and initially diversified in the Neotropics, with some of the lineages subsequently dispersing to other regions. If the tentative internal phylogenies of *Epeolus* and *Triepeolus* are correct, the basal species of both genera are found in the Old World. One explanation for this pattern might be that these epeolines were able

to reach Africa when it was still in close proximity to South America. An early African lineage of *Epeolus* may have then successfully diversified in the Old World, while lineages of both *Epeolus* and *Triepeolus* concurrently experienced large radiations in North America. However, this scenario would rely on the extinction of New World *Triepeolus* and *Epeolus* stem lineages, and on the retention of plesiomorphic traits in Old World species. It would also rely on the extinction of *Triepeolus* in Africa and the Middle East, with the few known Palearctic *Triepeolus* representing the lone survivors of this African radiation. An alternative hypothesis is that stem lineages of *Epeolus* and *Triepeolus* might have obtained a Holarctic distribution by dispersing over Beringia, with subsequent Palearctic/Nearctic vicariance, and subsequently with further Africa/Palearctic vicariance (a similar scenario was proposed by Ascher, 2004, for Andrenidae). Unfortunately, the fossil record of Nomadinae is unknown and so cannot help shed light on the origin and diversification of epeoline bees; however, the fossil record of other insect taxa shows that several groups now endemic to the southern hemisphere once had northern distributions (Engel, 2001). Discussion of the likelihood of such scenarios is postponed until more robust phylogenies of these genera are produced.

Despite the relatively great diversity of genera in the Neotropics, the two genera with the greatest number of species and the widest distributions are not especially diverse in that region. Of the approximately 140 species of *Triepeolus*, only 24 are known from the Neotropics (herein delineated as South and Central

America, and those Mexican states south and east of, and including, Veracruz and Oaxaca); similarly, *Epeolus* appears to have the largest number of species in North and Central America and the Palearctic (Michener, 2000). If host diversity helps to drive parasite cladogenesis, then the relative lack of eucerine diversity at the generic level in the Old World may help explain the paucity of *Triepeolus* species there. In contrast, the relative numbers of species of *Triepeolus* in North America as opposed to South America is enigmatic; eucerines are relatively abundant throughout the New World and have a higher generic diversity in South America, although the genera which most commonly serve as hosts for *Triepeolus* (i.e., *Melissodes*, *Svastra*, and *Tetraloniella*) are particularly abundant in the Nearctic (Michener, 2000). Similarly, the high diversity of *Colletes* in South America does not correlate well with relative scarcity of *Epeolus* there, although it may be correlated with the evolution of species of *Epeolus* with remarkable synapomorphies, such as the primarily Neotropical group *Trophocleptria*. The scarcity of *Epeolus* in South America may also be correlated with the presence of another cleptoparasite on *Colletes* in that continent, namely *Isepeolus* (tribe Isepeolini) (Ascher, in litt., 2006). The high species diversity of these parasite genera in the Nearctic may simply reflect the general trend for higher parasite diversity in temperate, particularly xeric, regions because of the role that high seasonality plays in synchronizing host and parasite ontogeny (Wcislo and Cane, 1996), although temperate xeric regions also exist in some South American countries. It may also simply be that *Triepeolus* and *Epeolus* diversified primarily

in the Holarctic, and that species in the Neotropics represent lineages that dispersed southwards from North America.

STUDIES OF *TRIEPEOLUS*: INTRODUCTION

The purpose of this section is to provide an overview of the worldwide fauna of *Triepeolus*. Using the keys presented herein, it is possible to key all females to species except for many of those belonging to two subgroups within the genus, namely the *T. verbesinae* and the *T. simplex* species groups (defined below). A list of taxa belonging to these species groups is included. In addition, it is possible to key both males and females (to the extent that both genders are known) of all species found in North America east of the Mississippi River, and of all species found in South America and the Caribbean. In the keys to both of these more limited geographical regions (in terms of both physical area and species diversity), species of the *T. verbesinae* and *T. simplex* species groups are included. Additional information is presented for each species found in the three keys presented herein, in the form of a taxonomic history, short description, additional comments, geographic distribution, host and plant data (if known), and a tally of the number of specimens examined for this study, including their repositories. In addition, a few of the more distinctive species of the *T. verbesinae* and *T. simplex* groups are diagnosed in a similar manner, despite their exclusion from any of the keys presented herein. Although the main focus of this study is an examination of the females of this genus, where known, males are also included in these treatments. In the diagnoses, if the male of a certain species is stated to be unknown, it is not necessarily an indication of the rarity of that gender; rather it is the result of the narrowed focus of this study. In many cases, it

was a straightforward matter to associate male type specimens with female kinds; in others it was a detailed process of elimination; and in still others a name associated with a male holotype could not be definitively associated with a female kind. Names that are currently unassociated with a female kind or that cannot be definitively associated with either the *T. verbesinae* or *T. simplex* species groups are listed at the end of the Diagnoses section, under the heading "Unplaced Species Names." A detailed analysis of the females within the *T. verbesinae* and *T. simplex* species groups and all of the males is in preparation and will undoubtedly help to clarify many of the names based on male types that were not definitively associated with a female kind. In addition, in a few instances it was impossible to locate the primary type specimen or series of a species name (see below).

In the *Triepeolus* Descriptions section, unless otherwise noted, all listed distributional, plant, and seasonal data are from specimens personally examined. Host data were gathered from personally examined specimens as well as from published literature and communications with other researchers; the sources of data are indicated when the specimens were not examined. I have not recorded published plant associations herein; they are both considerably more numerous than those of the hosts, and potentially less species-specific for cleptoparasitic bees such as *Triepeolus* than for other bees. Due to the general confusion historically surrounding the identity of many of the species of *Triepeolus*, published host data must generally be approached with some skepticism;

however, many convincing associations have been established. A list of the known and potential host associations with *Triepeolus* species is included in Appendix 3.

The majority of *Triepeolus* species names were proposed by T.D.A. Cockerell, who also provided a number of keys to limited geographical areas, often including both *Epeolus* and *Triepeolus* within the same keys [e.g., Cockerell, 1889 (New Mexico species); 1904: 34-35;1905a: 313-314 (Smith types), 1907b: 248-249 (Boulder Colorado species), 1907c: 62, 1921: 13-15 (Rocky Mountain species), and 1928a: 107-111 (Colorado species)]. Other, similarly limited keys, were provided by Robertson (1903: 284-287, primarily for Illinois species) and Brues (1903: 79-80, for Texas species). Unfortunately, confusion resulted from the failure of many of these authors to distinguish *Epeolus* from *Triepeolus*, and to associate males and females within each of the genera. Thus, a number of synonymous names were created for species based on different genders, or due to overlooking a name that was proposed in the incorrect genus. Strides towards correcting these problems were made by Linsley and Michener (1939: 299-301, plates xv-xviii), who redescribed and provided a more accurate understanding of the genus. Moure (1955: 123-132) provided the first comprehensive treatment for a subset of the species (of South America), followed by Mitchell (1962: 459-485, for the eastern U.S. species). Robertson (1928) listed a number of floral associations with many *Triepeolus* species, and Hurd et al. (1980) provided a list of species visiting *Helianthus* flowers.

There have been 169 species names proposed for *Triepeolus*. Many are not clearly recognizable from the original descriptions, and subsequent publications and determinations have to be evaluated carefully. I have seen the primary type specimen or series for each of these names except for fifteen. Those names are: *Epeolus penicilliferus* Brues, *Epeolus scelestus tubercularis* Brues, *Triepeolus hopkinsi* Cockerell, *Triepeolus pomonalis* Cockerell, *Epeolus luctuosus* Eversmann, *Triepeolus cuabitensis* Genaro, *Triepeolus roni* Genaro, *Triepeolus signatus* Hedicke, *Doeringiella nemoralis* Holmberg, *Triepeolus atoconganus* Moure, *Epeolus lunatus* Say, *Epeolus quadrifasciatus* Say, *Epeolus osiriformis* Schrottky, *Epeolus mercatus* Fabricius, and *Melecta remigata* Fabricius. However, I did have access to several high-quality photographs of the *Epeolus osiriformis* Schrottky holotype, to a paralectotype of *Triepeolus atoconganus* Moure, and to paratypes of the two Genaro species, *Triepeolus cuabitensis* and *Triepeolus roni*. Further comments regarding these species names can be found under the individual entries in the *Triepeolus* Descriptions section, below.

Several *Triepeolus* species names are based on lectotype specimens. Cockerell frequently designated "type" and "cotype" specimens when describing new species; however it was not necessary to designate lectotype specimens for his species because he intended specimens labeled "type" to be considered holotypes, and those labeled "cotype" to be considered paratypes (C. D. Michener, personal communication, 2006).

KEY TO FEMALES OF NORTH AND CENTRAL AMERICAN *TRIEPEOLUS*

1. Upper face with erect setae such that clypeus appears recessed (Fig. 309) (clypeus shining, with regularly-spaced small punctures and dense, minute, weakly impressed punctures; mesepisternum with erect, simple setae (Fig. 297); S5 strongly downcurved, Fig. 215) 2

— Upper face with setae variable, but not such that clypeus appears recessed 3

2(1). Metasomal terga with bands of setae grading from pale yellow to greyish white posteriorly; T2 with lateral longitudinal band of pale setae absent or forming very weakly acute angle with apical transverse band of pale setae (Fig. 354) ..... sp. 10

— Metasomal terga with bands of setae the same shade of pale yellow throughout; T2 with lateral longitudinal band of pale setae forming 90 degree angle with apical transverse band of pale setae (Fig. 307) .... *T. robustus*

3(1). Pseudopygidial area with long, erect setae forming rounded, three-dimensional posterior structure (i.e., similar to that of *T. concavus*, Fig. 214) (S5 strongly downcurved) 139

— Pseudopygidial area not similar to that of *T. concavus* 4

4(3). Intercoxal area of mesosoma posteriorly forming clasper-like structure (Fig. 207) (preoccipital carina very strong, outcurved on gena; mesepisternum with erect, simple setae) ..... *T. balteatus*

— Intercoxal area mostly flat, sometimes slightly reflexed towards body at apex 5

5(4). Pseudopygidial area as in Fig. 239, with subapical transverse band of silvery, fine, appressed setae and apical band of long, stout, suberect setae ..... *T. epeolurus*

— Pseudopygidial area variable, but lacking transverse subapical band of silver setae 6

6(5). Pseudopygidial area as in Figs. 187 and 249, with setae long and parted medially, apical margin concave ..... *T. heterurus*

— Pseudopygidial area variable, but lacking long, medially-parted setae like those in Figs. 187 and 249 7

7(6). Preoccipital carina absent or very faint on lower gena; head in dorsal view globular and shining beneath erect setae (pseudopygidial area as in Figs. 223 and 274, with apical margin concave or straight, and with transverse apical band of sparse, stout setae; mesepisternum with dense, erect setae; scutum with paramedian band of setae absent or poorly differentiated from erect setae present anteriorly; dorsal aspect of body black with white bands of setae) 8

— Preoccipital carina present at least on gena; head shape usually more conspicuously wider than long 9

8(7). T1 with basal transverse band of pale setae (Fig. 482); T2 with lateral longitudinal band of pale setae (southwestern U.S.) .....*T. mojavensis*

— T1 lacking basal transverse band of pale setae (Fig. 473); T2 lacking lateral longitudinal band of pale setae (north midwestern U.S. and Canada) ..... *T. dacotensis*

9(7). Scutellum covered with pale yellow setae, encircling two black or reddish brown regions of setae on biconvexities, axillar spine bordered on all sides with pale yellow setae (Fig. 402) (mesepisternum with erect, simple setae; pseudopygidial area with apical margin weakly convex or straight) 10

— Scutellum lacking distinct regions of dark setae encircled by pale setae on biconvexities, axillar spine rarely bordered on all sides with pale setae 11

10(9). Clypeus and mesepisternum shining, with sparse setae; mesepisternum with punctures separated by up to 1 to 5 puncture diameters; pseudopygidial area with basal crescent of silvery setae poorly differentiated from rest of setae ..... sp. 92

— Clypeus and mesepisternum mostly covered with pale yellow, plumose setae, mesepisternum with punctures nearly contiguous to separated by up to 1 puncture diameter; pseudopygidial area with basal crescent well differentiated from rest of setae (California) ..... sp. 90

11(9). T1 with apical transverse band of pale setae absent or greatly reduced (mesepisternum lacking erect, simple setae) 12

— T1 with apical transverse band of setae present 14

12(11). Pseudopygidial area with apical margin concave (Fig. 433), laterally with stout, spine-like setae; scutum lacking paramedian band of setae .... *T. mexicanus*

— Pseudopygidial area with apical margin weakly or strongly convex, lacking spine-like setae laterally; scutum with paramedian band of setae 13

13(12). Pseudopygidial area circular, with apical margin strongly convex, and with suberect setae on disc and dense, stout setae on apical margin (Fig. 445); paramedian band of setae tapering towards anterior margin of scutum ..... *T. bilineatus*

— Pseudopygidial area subquadrate, covered with dense, fine, appressed, golden setae, with apical margin weakly convex (Fig. 213); paramedian band of setae ending abruptly, not reaching anterior margin of scutum ..... *T. cameroni*

14(11). Pseudopygidial area rectangular, with setae uniformly very dense and short, apical margin straight, with setae reflecting silver (Fig. 229); T1 mostly covered with appressed yellow setae except for small, diamond, ovate, or rectangular patch of black setae mediobasally (Fig. 228) (axillar

spine exceeding posterior margin of scutellum, incurved, often red) .....
..... *T. distinctus*

— Pseudopygidial area variable but not so distinctly rectangular and with setae so uniformly dense and short; T1 with black interspace variable, less commonly reduced to small mediobasal patch 15

15(14). Scutellum red (rarely partially black), strongly contrasting with black scutum and axilla (axilla small and triangular, lacking free apical spine; upper face, scutum, and upper mesepisternum covered with dense, erect, golden setae; scutum lacking distinct paramedian band of setae; pseudopygidial area poorly differentiated from rest of T5) .... *T. intrepidus*

— Scutellum black or rarely red (if red then axilla also red) 16

16(15). Pseudopygidial area strongly triangular, distinctly longer than wide, composed of silvery setae except for small medial patch of darker setae (Fig. 227); dorsal aspect of body entirely black (some specimens from Utah) or with banding of appressed, pale yellow setae (if with pale banding, then T2 with lateral longitudinal band of pale setae reduced or forming 90 degree angle with apical transverse band of pale setae; mesepisternum with relatively short, sparse, erect, simple setae) (North Dakota and Montana south to Arizona, New Mexico, and Chihuahua) ..... *T. denverensis*

— Pseudopygidial area variable in shape, if composed mostly of silvery setae except for small medial patch of darker setae, then pseudopygidial area

about as long as wide; dorsal aspect of body with at least some pale yellow bands of setae 17

17(16). Pseudopygidial area distinctly circular, with apical margin strongly convex, and with setae relatively sparse on disc, dense and stout on apical margin (Fig. 188a); S5 *usually* strongly downcurved (North American species), or weakly downcurved to straight in profile (South American species) (axillar spines usually short; clypeus usually lacking midline) .... *T. verbesinae* species group

— Pseudopygidial area variable, sometimes ovate, but not distinctly circular; if rounded then lacking combination of sparse setae on disc and dense setae at apical margin; S5 rarely strongly downcurved 18

18(17). Pseudopygidial area triangular, sometimes with stout setae laterally, apical margin concave or straight (e.g., pseudopygidial areas in Figs. 433–439); S5 straight in profile, apical margin with dense bristle-like setae (clypeus often lacking midline) ..... *T. simplex* species group

— Pseudopygidial area variable, but with apical margin straight or convex, and never with stout lateral setae; S5 shape in profile variable but lacking dense bristle-like setae on apical margin 19

19(18). T5 with pale lateral setae absent or restricted to apicolateral margin of tergum (e.g., Fig. 321) 20

— T5 with pale lateral setae bordering or adjacent to at least most of lateral margin of pseudopygidial area (e.g., Fig. 322) 27

20(19). Mesepisternum with long, erect, simple setae 21

— Mesepisternum lacking long, erect, simple setae 22

21(20). T1 lacking basal transverse band of setae .....*T. texanus* (in part)

— T1 with basal transverse band of setae ..... sp. 134

22(20). Pseudopygidial area long and narrow (with apical semicircular region of coarser setae; Fig. 329) ..... *T. tanneri*

— Pseudopygidial area as wide as long, or wider 23

23(22). Pseudopygidial area strongly triangular (paramedian band of pale setae joined laterally to pale yellow setae on anterior margin of scutum) .... *T. martini*

— Pseudopygidial area ovate to subrectangular 24

24(23). Scutum with dense yellow setae on entire anterior margin (Fig. 278); T2 with lateral longitudinal band of pale setae forming 90 degree angle with apical transverse band of pale setae ..... *T. nevadensis*

— Scutum lacking pale setae on anterior margin; T2 with lateral longitudinal band of pale setae absent or forming acute angle with apical transverse band of pale setae 25

25(24). Scutum and clypeus shining; pseudopygidial area relatively wide, forming band on apical margin of T5 (Fig. 327) (clypeus with distinct larger punctures present) ..... *T. subnitens*

— Scutum and clypeus relatively matte; pseudopygidial area longitudinally ovate to subquadrate, not forming band on apical margin of T5 26

26(25). T2 with apical transverse band of pale setae broken medially; metasomal sterna lacking bands of pale yellow setae ..... *T. scelestus*

— T2 with apical transverse band of pale setae continuous; metasoma with apical transverse bands of pale setae laterally on at least S3 .... *T. helianthi* (in part)

27(19). Pseudopygidial area with setae uniform or nearly uniform in reflectance, texture, and density 28

— Pseudopygidial area not uniform in reflectance, texture, and/or density 57

28(27). Scutum with pale yellow setae on anterior margin, joined laterally to submedian bands of setae (Fig. 305) ..... *T. remigatus*

— Scutum lacking pale yellow setae on anterior margin 32

29(28). Mesepisternum with erect, simple setae (Fig. 297, sometimes short and sparse) 30

— Mesepisternum lacking erect, simple setae 36

30(29). Pseudopygidial area triangular, with silvery reflecting setae 31

— Pseudopygidial area rounded, with dark (or rarely pale) golden reflecting setae 32

31(30). Scutum with paramedian bands of setae ..... *T. subalpinus*

— Scutum lacking paramedian bands of setae ..... *T. brittaini*

32(30). Mesepisternum with erect setae as long as median ocellus diameter (axillar spine at least reaching, but usually surpassing, midpoint of scutellum; metasomal terga with bands of pale setae relatively robust) 33

— Mesepisternum with erect setae only ca. 0.5 median ocellus diameter or less in length 34

33(32). Metasomal terga with bands of setae pale yellow; legs red (rarely black); axillar spine triangular, reaching midpoint of scutellum, or less commonly sharply pointed and apically incurved, well-surpassing midpoint of scutellum (southern Mexico to southwestern U.S.) ..... *T. grandis*

— Metasomal terga with bands of setae orange-yellow to yellow; legs black; axillar spine long, pointed, apically incurved (southern Mexico to Costa Rica) ..... *T. zacatecus*

34(32). T1 interspace widely rectangular with sinuate basal and apical transverse bands of pale setae (Fig. 275); body length greater than 15 mm (integument entirely black; axillar spine pointed, reaching posterior margin of scutellum) (southeastern U.S.) ..... *T. monardae*

— T1 interspace widely ovate or triangular; body length less than 14 mm (southwestern U.S., Mexico, and Central America) 35

35(34). Legs red; T1 interspace widely ovate, basal and apical transverse bands of pale setae parallel; pseudopygidial area with setae pale golden brown .... sp. 179

— Legs black, or if partly red then T1 interspace triangular; T1 interspace triangular or widely ovate; pseudopygidial area with setae dark brown, reflecting darkly golden ..... *T. tepanecus* group (Table 5)

36(29). Pseudopygidial area rounded apically, elongated basally into tear shape (Fig. 259); S5 strongly downcurved; T1 interspace very widely subovate to diamond-shaped (Fig. 258) (Arizona, New Mexico, and Durango) .... *T. loomisorum*

— Pseudopygidial area variable but not elongated basally into tear shape; S5 straight or moderately downcurved in profile; T1 interspace rarely wide diamond-shaped 37

37(36). T1 lacking lateral and basal transverse bands of pale setae or rarely with basal transverse band reduced to small patch on basolateral corner of T1; T2 lacking lateral longitudinal band of pale setae (scutum with paramedian band of setae absent or rarely reduced; integument of face entirely dark brown, or with limited orange-red regions on F1 and F2) (central Mexico) ..... sp. 141

— T1 with basal transverse bands of pale setae, if reduced then lateral longitudinal band of pale setae strongly present; T2 with lateral longitudinal band of pale setae present, or if absent then T1 with basal transverse band of pale setae 38

38(37). T1 with basal and apical transverse bands of pale setae linear and parallel to each other along most of width, thus T1 interspace rectangular or widely ovate (e.g., Figs. 246 and 372) 39

— T1 with basal and apical transverse bands of pale setae not linear, not parallel to each other along most of width, thus T1 interspace appearing ovate, subquadrate, or triangular 51

39(38). T1 lacking lateral longitudinal band of pale setae 40

T1 with lateral longitudinal band of pale setae 41

40(39). Integument with red regions on antenna, labrum, pronotal lobe, tegula and legs; pseudopygidial area relatively widely semicircular, poorly defined basally from rest of T5 (Fig. 385) ..... sp. 62

— Integument entirely dark brown to black (excluding mandibles); pseudopygidial area longitudinally ovate, with basal boundary well defined by change in setal morphology (Fig. 370) ..... sp. 43

41(39). T1 with lateral longitudinal band of pale setae forming 90 degree angle with apical transverse band of pale setae, thus T1 interspace appearing strongly rectangular (e.g., Fig. 372) 42

— T1 with lateral longitudinal band of pale setae forming acute angle with, or rounded connection between, basal and apical transverse bands of pale setae, thus T1 interspace appearing widely ovate (e.g., Fig. 246) 46

42(41). Scutum and clypeus shining; body length ca. 11–16 mm 43

— Scutum and clypeus relatively matte; body length ca. 7–11 mm 44

43(42). T2 lacking lateral longitudinal band of pale setae; axillar spine pointed, surpassing scutellar midpoint (southeastern U.S.) .... *T. quadrifasciatus atlanticus*

— T2 with lateral longitudinal band of pale setae forming acute angle with apical transverse band of pale setae; axillar spine triangular, reaching scutellar midpoint (western and midwestern U.S., northern Mexico) .... *T. subnitens*

44(42). Mesepisternum with pale, plumose setae restricted to small patches below scrobal groove and posterior to pronotal lobe; metanotum with pale setae restricted to lateral corners ..... sp. 43

— Mesepisternum with pale, plumose setae on much of dorsal half or more; metanotum mostly or entirely covered with pale setae 45

45(44). Pseudopygidial area subrectangular to subtriangular, with setae weakly directed laterally, and apical margin of integument straight, often appearing slightly concave due to longer setae laterally than medially; T2 with apical transverse band of pale setae continuous; T1 interspace not strongly resembling plus-sign ..... sp. 65

— Pseudopygidial area rounded, with setae mostly directed posteriorly, and apical margin of integument straight to weakly convex; T2 with apical transverse band of pale setae interrupted medially (sometimes only barely); T1 interspace resembling plus-sign (Fig. 372) ..... sp. 44

46(41). Scutum with diffuse pale yellow setae along anterior margin, forming subtle anchor-shape with paramedian bands of setae; T2 with lateral longitudinal band of pale setae forming 90 degree angle with apical transverse band of pale setae (or, rarely forming acute angle at apical third) (pseudopygidial area subrectangular to subtriangular, with setae weakly directed laterally, and apical margin of integument straight, often appearing slightly concave due to longer setae laterally than medially; Fig. 389) ..... sp. 65

— Scutum lacking diffuse pale yellow setae along anterior margin, with paramedian bands of setae isolated from other pale setae on scutum; T2 lacking lateral longitudinal band of pale setae, or with this band forming acute angle with apical transverse band of pale setae 47

47(46). Scutum and clypeus shining; pseudopygidial area forming transverse band on apical margin of T5 (Fig. 327) (clypeus with distinct larger punctures, Fig. 462) ..... *T. subnitens*

— Scutum relatively matte, clypeus shining or matte; pseudopygidial area longitudinally ovate to subtriangular, not forming transverse band on apical margin of T5 48

48(47). Body length ca. 15–18 mm; integument entirely black; axillar spine pointed, surpassing midpoint of scutellum (southeastern U.S.) .... *T. monardae*

— Body length ca. 8–12 mm; integument entirely black or with red regions; axillar spine triangular, reaching only midpoint of scutellum 49

49(48). Clypeus lacking or with faint midline; T2 with lateral longitudinal band of pale setae absent or reduced; pseudopygidial area dark, poorly differentiated from rest of T5 (Fig. 321) ..... *T. scelestus*

— Clypeus with strong (rarely faint) midline; T2 with lateral longitudinal band of pale setae forming acute angle with apical transverse band of pale setae (rarely reduced); pseudopygidial area usually easily differentiated from rest of T5 50

50(49). Clypeus shining, with distinct larger punctures; pseudopygidial area with apical margin of integument straight, and setae golden brown; S2–4 with white setae (Arizona, New Mexico) ..... sp. 179

— Clypeus relatively matte, lacking or with vague larger punctures; pseudopygidial area with apical margin of integument weakly convex, setae brown to golden brown; S2 lacking white setae, S3–4 with white setae ..... *T. helianthi*

51(38). T1 with lateral area of pale setae enlarged, as wide as or wider than width of T1 interspace 52

— T1 with lateral area of pale setae not especially enlarged, narrower than width of T1 interspace 54

52(51). Body length ca. 7–11 mm; T1 interspace located basally on disk of tergum (Fig. 203) (Costa Rica) ..... *T. aztecus*

— Body length ca. 13–16 mm; T1 interspace reduced to thin, longitudinal line or located medially on disk of tergum (Texas and Kansas to east coast of U.S.) 53

53(52). Clypeus entirely red; scutellum and axilla often reddish; T1 mostly covered with pale yellow setae, except for median longitudinal line of dark brown setae (Fig. 302; sometimes with small diamond or ovate median area of dark setae as well) (Texas and Kansas to Louisiana) .... *T. q. quadrifasciatus*

— Clypeus at most red apically; scutellum and axilla black; T1 interspace usually ovate to rectangular, sometimes as above (Fig. 196) (eastern U.S.) ..... *T. quadrifasciatus atlanticus*

54(51). T1 interspace widely ovate, with enlarged circular region medially (Fig. 210) (western U.S.) 55

— T1 interspace subtriangular to ovate, if widely ovate then lacking enlarged median circular region. 56

55(54). T2 with lateral longitudinal band of pale setae forming strongly acute angle with apical transverse band of pale setae; dorsal aspect of body often with bright yellow bands of setae; pseudopygidial area with setae golden ..... *T. californicus*

— T2 with lateral longitudinal band of pale setae forming 90 degree angle with apical transverse band of pale setae; dorsal aspect of body with pale yellow bands of setae; pseudopygidial area with setae rust colored .. sp. 39

56(54). Metasomal terga with bands of pale setae medially broken and slightly enlarged, causing the metasoma to superficially resemble that of *T. verbesinae* (Fig. 324); paramedian band of setae narrowed anteriorly, reaching anterior margin of scutum; pseudopygidial area slightly emarginate medioapically (Fig. 325) ..... *T. sublunatus*

— Metasomal terga with transverse bands of pale setae remaining a similar width medially as laterally, not resembling those of *T. verbesinae*; paramedian band of setae absent, or present and truncate anteriorly, not reaching anterior margin of scutum; pseudopygidial area evenly straight or convex on apical margin ..... *T. tepanecus* species group (Table 5)

57(27). Pseudopygidial area widely triangular, golden, with dense, short, suberect setae (Fig. 233) 58

— Pseudopygidial area variable, but lacking similarly dense, short, suberect setae as shown in Fig. 233 59

58(57). T2 with lateral longitudinal band of pale setae forming 90 degree angle with apical transverse band of pale setae; mesepisternum with punctures very small, contiguous; body length ca. 10–13 mm (western U.S., east to Colorado) ..... *T. diversipes*

— T2 with lateral longitudinal band of pale setae forming acute angle with apical transverse band of pale setae; mesepisternum with small punctures separated by up to 0.5 puncture diameter; body length ca. 7–8 mm (Arizona) ..... sp. 60

59(57). Mesepisternum with erect setae ca. 0.5 OD in length or more 60

— Mesepisternum lacking erect setae or with erect setae less than 0.25 OD in length 82

60(59). T2 with lateral longitudinal band of pale setae forming 90 degree angle with apical transverse band of pale setae 61

— T2 with lateral longitudinal band of pale setae absent or forming acute angle with apical transverse band of pale setae 71

61(60). Clypeus extending below lower tangent of compound eyes by ca. 1.5 OD or more 62

— Clypeus with apical margin ca. in line with lower tangent of compound eyes, or surpassing by no more than 1 OD 64

62(61). Apical third of hind wing distinctly darker than basal two-thirds; mesepisternum irregularly, deeply punctate (Fig. 318) (eastern U.S.) .... *T. rugosus*

— Hind wing uniformly transparent or only slightly darker at apical third; mesepisternum with small, relatively shallowly impressed punctures 63

63(62). Dorsal aspect of body with whitish grey bands of setae; clypeus with larger punctures vague; mesepisternum shining between punctures, lower mesepisternum with punctures mostly spaced about a puncture diameter apart (eastern and midwestern U.S.) ..... *T. donatus*

— Dorsal aspect of body with pale yellow bands of setae; clypeus with distinct larger punctures; mesepisternum not especially shining, with

punctures nearly contiguous (sometimes with punctures spaced a puncture diameter apart in some areas) ..... *T. texanus*

64(61). Pseudopygidial area a longitudinally elongate triangle (with setae uniformly short, appressed, and dense, and with distinct basal and apical regions of silvery setae; Fig. 368) (Utah west to California) ..... sp. 42

— Pseudopygidial area variable, but if triangular then not so longitudinally elongate 65

65(64). Pseudopygidial area triangular, mostly composed of shining golden setae but with area of shining silvery setae on basal third to fourth (golden and silvery setae similarly long and dense, Fig. 311) (Colorado) ..... *T. rohweri*

— Pseudopygidial area ovate to subtriangular, with basal crescent of setae distinctly denser and shinier than that of rest of area, or with pseudopygidial area mostly dark, with vague basal silvery shining crescent 66

66(65). Lower mesepisternum shining, with punctures spaced well over three puncture diameters apart (mesepisternum with erect, simple setae especially long, Figs. 296 and 297) (clypeus with strong midline; T2 with lateral longitudinal band of pale setae usually forming weakly acute angle with apical transverse band of pale setae) ..... *T. pectoralis*

— Lower mesepisternum variable, but with punctures separated not more than two puncture diameters apart 67

67(66). Axilla slightly longer than wide, with distinct apical spine curved medially, reaching or surpassing scutellar midpoint; pseudopygidial area with well defined region of silvery setae on basal third to half of area (paramedian band of setae distinct from other regions of pale setae on scutum) 68

— Axilla as long as wide or shorter, lacking or with very small apical spine, reaching or shorter than scutellar midpoint; pseudopygidial area with vague or distinct basal region of silvery setae confined to basal fourth or less of area 69

68(67). T1–4 with apical transverse bands of pale setae broken medially (California: San Luis Obispo) ..... sp. 144

— At least T3–4 with apical transverse bands of pale setae continuous (California: Antioch) ..... sp. 78

69(67). Mesepisternum entirely, though somewhat sparsely, covered with pale yellow, appressed, plumose setae; preoccipital carina strong, outcurved on entire gena; T1 interspace forming rectangular region of dark setae reaching lateral margin of tergum (as seen in dorsal view) (mesepisternum with integument beneath plumose setae rugose and shining; paramedian band joined laterally to pale yellow setae on anterior third to fourth of scutum; vertex and scutum with dense, golden, erect setae) (Utah, Texas) ..... sp. 174

— Mesepisternum with pale yellow, appressed, plumose setae restricted dorsally, or if covering entire mesepisternum, then these setae very dense such that integument beneath poorly visible; preoccipital carina strong or weak on gena, butrarely strongly outcurved; T1 interspace reduced or forming rectangular region, but rarely so wide as to reach lateral margin of tergum (as seen in dorsal view) 70

70(69). Pseudopygidial area dark brown, with vague basal crescent of shining setae (Fig. 413); T5 with patch of white setae lateral to pseudopygidial area usually reduced or absent (California, Oregon) ..... sp. 134

— Pseudopygidial area with distinct basal crescent of silvery shining setae; T5 with large patch of white setae lateral to pseudopygidial area ....*T. paenepectoralis* species group (Table 4)

71(60). Pseudopygidial area well-defined, longitudinally ovate, with region of golden setae at apical margin (Fig. 281) ..... *T. nigrihirtus*

— Pseudopygidial area variable, but if longitudinally ovate then not so well defined on basal margin and lacking such highly differentiated region of golden setae at apical margin 72

72(71). Pseudopygidial area longitudinally ovate, entirely covered with dense, shining setae, apically with depressed, circular region (Fig. 423); S5 strongly downcurved (clypeus lacking midline) (California) ..... sp. 170

— Pseudopygidial area variable but lacking apical, depressed, circular region; S5 straight or only weakly downcurved in profile 73

73(72). Lower mesepisternum shining, with punctures spaced well over three puncture diameters apart (clypeus with strong midline; mesepisternum with erect, simple setae especially long) ..... *T. pectoralis*

— Lower mesepisternum variable, but with punctures separated not more than two puncture diameters apart 74

74(73). Clypeus extending below lower tangent of compound eyes by ca. 1.5 OD or more 75

— Clypeus with apical margin ca. in line with lower tangent of compound eyes, or surpassing by no more than 1 OD 76

75(74). T1 lacking basal transverse band of pale setae; mesepisternum with integument relatively smooth, with fine punctures (Washington) .... *T. texanus* (in part)

— T1 with basal transverse bands of pale setae; mesepisternum with integument rugose, with relatively deeply impressed, larger punctures (eastern U.S.) ..... *T. rugosus*

76(74). Pseudopygidial area relatively poorly differentiated from rest of T5 except for silvery shining setae at apical margin, resembling that of *Epeolus* (Fig. 419) (mesepisternum with erect setae mostly restricted to anterior margin; clypeus lacking midline) (California) ..... sp. 143

— Pseudopygidial area relatively well-defined, especially basally on T5, lacking apical band of silvery setae resembling that of *Epeolus* 77

77(76). Pseudopygidial area longitudinally ovate, usually darkly shining, with a vague basal crescent of denser setae (Fig. 245); T1 interspace triangular to subquadrate; body length ca. 11–15 mm; T1–2 often with apical transverse bands of pale yellow setae broken and slightly broadened medially (southern and midwestern U.S., Mexico) ..... *T. grandis*

— Pseudopygidial area rarely longitudinally ovate *and* nearly uniformly composed of darkly shining setae; T1 interspace variable but rarely triangular; body usually shorter than 13 mm; T1–2 with apical transverse bands of pale yellow setae nearly the same width medially as laterally .. 78

78(77). Clypeus flat, shining, black, usually strongly contrasting with red antennal scape and labrum (pseudopygidial area triangular, with distinct, narrow basal crescent of shining setae; T1 with apical and basal transverse bands of pale yellow setae parallel, forming wide ovate interspace) (northern Mexico, southwestern U.S.) ..... sp. 74

— Clypeus at least weakly convex in profile, usually not strongly contrasting with scape and labrum in color 79

79(78). Venter of body entirely covered with dark brown or black setae; T1–2 with apical transverse bands of pale setae unbroken medially ..... sp. 134

— Venter of body with at least some pale yellow or white setae; T1–2 with apical transverse bands of pale setae usually broken medially (rarely entire) 80

80(79). T1 with apical transverse band of pale setae medially interrupted by less than 1 OD (pseudopygidial area longitudinally ovate, with distinct basal shining crescent) (North Dakota and Montana south to California and New Mexico) ..... *T. fraserae*

— T1 with apical transverse band of pale setae medially interrupted by more than 1 OD 81

81(80). Mesepisternum with only simple, erect setae (minutely-branched, pale setae appressed or weakly suberect); antenna entirely dark brown; pseudopygidial area relatively wide, semicircular in outline (Mexico) ..... *T. medusa*

— Mesepisternum with simple *and* minutely-branched, erect setae, especially dorsally; antenna usually with at least F1 orange; pseudopygidial area relatively long, subquadrate in outline ..... *T. antiguensis*

82(59). Pseudopygidial area strongly triangular, with straight apical margin weakly shining silvery, contrasting with dark brown setae on rest of area (Fig. 265) (paramedian band joined laterally to pale yellow setae on anterior margin of scutum, forming anchor-shape; T2 with lateral longitudinal band of pale setae forming acute angle with apical transverse band of pale setae) (midwest and southwest U.S., northern Mexico) .... *T. martini*

— Pseudopygidial area variable, but not so perfectly triangular and nearly uniformly dark brown 83

83(82). At least lower two-thirds of mesepisternum intensely shining, black, almost entirely glabrous (T1 with apical transverse bands of yellow or pale yellow setae medially interrupted by at least 1 OD; axillar spines black) (Mexico) 84

— Lower mesepisternum not so distinctly shining, more conspicuously covered with setae 85

84(83). T2 with lateral longitudinal band of pale setae forming acute angle with apical transverse band of pale setae; mesepisternum with punctures usually separated by as much as 4–5 puncture diameters (only 2–3 puncture diameters in some specimens), with white, appressed, plumose setae covering much of upper third, excluding hypoepimeron; axillar spines pointed, slightly incurved apically, surpassing scutellar midpoint ..... sp. 19

— T2 lacking lateral longitudinal band of pale setae; mesepisternum with punctures usually separated by as much as 2 puncture diameters, with white, appressed, plumose setae usually limited to just below scrobal groove; axilla usually triangular, reaching scutellar midpoint (sometimes extended into spine surpassing scutellar midpoint) ..... *T. tepanecus*

85(83). Scutellum entirely or partially red 86

— Scutellum black 88

86(85). Metanotum covered with appressed, pale yellow setae, these setae the same color as paramedian band of setae (Colorado) ..... sp. 59

— Metanotum covered with appressed, black or brown setae, these setae distinctly darker than paramedian band of setae 87

87(86). Paramedian band absent or short, not reaching anterior margin of scutum; scutum usually red but sometimes partially or entirely black; body length ca. 10–14 mm (southeastern US) ..... *T. rufithorax*

— Paramedian band reaching anterior margin of scutum, often joined laterally to pale yellow setae on anterior margin of scutum; scutum usually black but sometimes with red areas; body length ca. 7–9 mm (Colorado west to California and Arizona) ..... sp. 51

88(85). Clypeus extending below lower tangent of compound eyes by ca. 1.5 OD 89

— Clypeus with apical margin ca. in line with lower tangent of compound eyes, or surpassing by no more than 1 OD 91

89(88). Dorsal aspect of body with bands of setae very pale white, almost grey (mesepisternum usually with short, erect setae) ..... *T. donatus*

— Dorsal aspect of body with bands of setae pale yellow 90

90(89). Paramedian band joined laterally to dense band of pale yellow setae on anterior margin of scutum (Fig. 305); T1 interspace triangular to semicircular, often only as wide as width of lateral longitudinal band of pale setae (Fig. 304); pseudopygidial area with basal and apical setae not strongly differentiated, but with apical setae slightly stouter and longer ..... *T. remigatus*

— Paramedian band not or only weakly joined laterally to pale yellow setae on anterior margin of scutum; T1 interspace triangular to widely ovate, wider than width of lateral longitudinal band of pale setae (Fig. 358); pseudopygidial area with basal and apical setae distinctly differentiated ..... sp. 18

91(88). T1 interspace strongly rectangular in shape (i.e., basal and apical transverse bands of pale setae parallel, and lateral longitudinal bands of pale setae forming 90 degree angle with transverse bands) 92

— T1 interspace shape variable but not strongly rectangular 99

92(91). Pseudopygidial area triangular to subquadrate, with apical margin straight or weakly convex, and basal and apical setae strongly differentiated; T1 interspace not forming plus-shape sign, with basal and apical transverse bands of pale setae often weakly interrupted medially (mesepisternum usually with sparse, short erect setae) 93

— Pseudopygidial area ovate, with apical margin strongly to weakly convex, and with basal and apical setae variable; T1 interspace often forming plus-shape sign (with basal and apical transverse bands of pale setae medially interrupted about same width as T1 interspace length, e.g., Fig. 372) (mesepisternum lacking erect, simple setae) 96

93(92). Pseudopygidial area longitudinally elongate and triangular, with setae uniformly short, appressed, and dense, and with differentiated basal and apical regions of silvery setae (Fig. 368) (Utah west to California) .. sp. 42

— Pseudopygidial area not longitudinally elongate and triangular, setae variable 94

94(93). Axilla slightly longer than wide, with distinct apical spine curved medially, reaching or surpassing scutellar midpoint; pseudopygidial area with well defined region of silvery setae on basal third to half of area (paramedian band of setae distinct from other regions of pale setae on scutum) 95

— Axilla as long as wide or shorter, lacking or with very small apical spine, reaching or shorter than scutellar midpoint; pseudopygidial area with vague or distinct basal region of silvery setae confined to basal fourth or less of area ..... *T. paenepectoralis*

95(94). T1–4 with apical transverse bands of pale setae interrupted medially (California: San Luis Obispo) ..... sp. 144

— At least T3–4 with apical transverse bands of pale setae continuous (California: Antioch) ..... sp. 78

96(92). S5 strongly downcurved; pseudopygidial area with well differentiated basal and apical setae 97

— S5 only moderately or not downcurved in profile; pseudopygidial area with poorly differentiated basal and apical setae 98

97(96). T1–4 with transverse apical bands of pale setae interrupted medially; legs black or dark brown (Puebla) ..... sp. 49

— Only T1 and sometimes T2 with apical bands of pale setae interrupted medially, T3–4 with bands continuous; legs red (Texas and northern Mexico) ..... sp. 61

98(96). Metanotum entirely covered with pale yellow setae, or with small patch of dark setae medially less than 1 OD in width (southwestern U.S. and northern Mexico) ..... sp. 44

— Metanotum with pale setae restricted to lateral corners, such that median dark patch of setae much wider than 1 OD ..... sp. 43

99(91). T1 with basal transverse band of pale yellow setae absent or nearly so; T2–4 with transverse apical bands of pale yellow setae uninterrupted medially; paramedian band usually reduced or absent; body length ca. 7–10 mm (Mexico south to Costa Rica) 100

— T1 with basal transverse band of pale setae present, or if reduced then at least T2–3 with apical transverse bands of pale yellow setae medially interrupted; T2–4 with apical banding variable; paramedian band usually strongly present; body length usually ca. 9–14 mm 101

100(99). T1 with apical transverse band of pale yellow setae interrupted medially; clypeus lacking or with faint midline; mesepisternum lacking erect, simple setae (Mexico) ..... sp. 141

— T1 with apical band of pale yellow setae continuous; clypeus with strong midline; mesepisternum with dense, but very short, erect setae (Costa Rica) ..... sp. 142

101(99). Pseudopygidial area strongly triangular, with distinct basal region of silvery setae (Fig. 353); axillar spine often with reddish tinge (paramedian band laterally contiguous with band of pale yellow setae on anterior margin of scutum) (southwestern and midwestern U.S.) ..... sp. 2

— Pseudopygidial area variable but not so strongly triangular with distinct basal region of silvery setae; axillar spine usually lacking reddish tinge 102

102(101). Paramedian band laterally contiguous with relatively dense band of pale yellow setae on anterior margin of scutum (Fig. 305) (T1 interspace reduced, ovate or triangular; T2 with lateral longitudinal band of pale setae forming 90 degree or obtuse angle with apical band of yellow setae, resulting in basal brown region appearing rectangular or semicircular) ..... *T. remigatus*

— Paramedian band distinct from other yellow setae on scutum, or if contiguous with other yellow setae, then T2 with lateral longitudinal band of pale setae forming acute angle with apical band of setae 103

103(102). T1 interspace triangular 104

— T1 interspace ovate, rectangular, or subquadrate 107

104(103). Pseudopygidial area 1.5 to 2 times as long as wide, or nearly so, with poorly differentiated region of silvery setae on basal third (Fig. 316) (T2–4 with apical transverse bands of yellow setae medially continuous, rarely T1 with apical transverse band of yellow setae minutely interrupted

medially) (Texas, Nuevo León, Tamaulipas, Jamaica, Grenada) ..... *T. rufoclypeus*

— Pseudopygidial area about as long as wide, or at most 1.5 times as long as wide, with silvery setae distinct or poorly differentiated, restricted to crescent at base of pseudopygidial area 105

105(104). Pseudopygidial area longitudinally ovate, with vague basal crescent of shining setae (southwestern U.S. south to El Salvador and Guatemala) ..... *T. laticeps*

— Pseudopygidial area subquadrate, with distinct basal crescent of silvery setae 106

106(105). Scutum with at least some red integumental coloration (southeastern U.S.) ..... *T. rufithorax*

—Scutum black (U.S. and northern Mexico) ..... *T. lunatus*

107(103). Pseudopygidial area resembling that of *Epeolus* (i.e., basally poorly differentiated from rest of T5, with transverse band of silvery setae on apical margin (Fig. 419) (axillae short and rounded, with minute free apical spine) ..... sp. 143

— Pseudopygidial area variable but lacking transverse band of silvery setae on apical margin resembling that of *Epeolus* 108

108(107). Pseudopygidial area wider than long, with apicolateral tufts of long, silvery setae (Fig. 364) (Texas) ..... sp. 37

— Pseudopygidial area usually as long as, or longer than, wide, lacking apicolateral tufts of long, silvery setae 109

109(108). Pseudopygidial area entirely with uniformly fine, dense setae, with basal half silvery and apical half pale golden (S5 straight in profile) ... 110

— Pseudopygidial area with at least some coarse, sparse setae, and with apical setae dark brown rather than pale golden 111

110(109). Pseudopygidial area rounded (Fig. 399) (northern Mexico) ..... sp. 81

— Pseudopygidial area quadrate (Fig. 397) (Texas) ..... sp. 80

111(109). Integument of body entirely black (excluding mandible and antenna); dorsal aspect with bands of setae pale grey, resembling those of *T. donatus* (pseudopygidial area round; S5 moderately to distinctly downcurved) 112

— Body coloration variable, but if legs black, then dorsal aspect of body with bands of setae yellowish 114

112(111). T5 and S5 distinctly narrowed posteriorly, thus T5 with apical margin bearing correspondingly small, subquadrate pseudopygidial area (at widest point, width ca. one fourth or less the width of T1 in dorsal view); lower mesepisternum with punctures minute, nearly contiguous (Mississippi) ..... *T. micropygius* (in part)

— T5 and S5 not so distinctly narrowed posteriorly, thus pseudopygidial area at its widest point ca. one third of T1 width; lower mesepisternum with punctures spaced a puncture diameter apart or more in some places 113

113(112). Lower mesepisternum with integument raised between punctures; pseudopygidial area with basal shining crescent strongly distinct from apical coarse setae (Fig. 201) (New York and North Carolina west to Illinois and Texas) ..... *T. atripes*

— Lower mesepisternum with integument flat between punctures; pseudopygidial area with basal shining crescent less clearly delineated from apical coarse setae (Fig. 243) (Florida, Georgia) ..... *T. georgicus*

114(111). Pseudopygidial area round, with apical margin convex, basal third to half with fine, silvery setae strongly contrasting with circular apical region of coarse setae (Figs. 271 and 393); S5 strongly downcurved (midwestern and western U.S.) 115

— Pseudopygidial area variable, but if basal half to third with fine, silvery setae, then pseudopygidial area quadrate (*or*, if pseudopygidial area as above, then S5 only slightly downcurved); S5 only moderately downcurved or straight in profile 116

115(114). Pseudopygidial area at widest point only ca. one fourth or less the width of T1, with shining setae only on basal third (Fig. 271) .... *T. micropygius*

— Pseudopygidial area at widest point one third the width of T1, with area of basal silvery setae equaling one half of entire pseudopygidial area length (Fig. 393) ..... sp. 76

116(114). All legs black or dark brown (sometimes paler brown on tarsi) 117

— At least hind leg orange or red, or at least tibiae of legs orange or red 121

117(116). T1 with basal and apical transverse bands of pale setae parallel to each other, enclosing wide ovate to rectangular region, with bands of pale setae uninterrupted medially or broken by less than 0.5 OD (California to Washington, east to Colorado) 118

— T1 with basal and apical transverse bands of pale setae variable, enclosing triangular or ovate region, with bands of pale setae medially interrupted by 1 OD or more (Arizona south through Central America) 119

118(117). T2 with lateral longitudinal band of pale setae forming 90 degree angle with apical transverse band of pale setae, or absent; pseudopygidial area with distinct basal crescent of silvery setae (mesepisternum usually with at least some short, erect, simple setae) ..... *T. paenepectoralis*

— T2 with lateral longitudinal band of pale setae forming acute angle with apical transverse band of pale setae; pseudopygidial area lacking distinct basal crescent of silvery setae (mesepisternum lacking erect, simple setae) ..... *T. helianthi*

119(117). Pseudopygidial area with distinct region of silvery setae on basal third to half (T1 interspace ovate) (Jalisco to Chiapas) ..... *T. totonacus*

— Pseudopygidial area lacking or with poorly differentiated basal region of silvery setae ..... 120 (*T. tepanecus* species group)

120(119). T1 interspace ovate; T1–4 with apical transverse bands of pale setae medially interrupted or nearly so; body length ca. 8–10 mm (Arizona and Sinaloa) ..... sp. 110

— T1 interspace triangular to quadrate; T2–4 with apical transverse bands usually uninterrupted medially; body length ca. 9–14 mm in length (Arizona to El Salvador) ..... *T. laticeps*

121(116). Pseudopygidial area with setae nearly uniformly pale brown or golden, with apical margin straight (T1 interspace widely ovate, with basal and apical transverse bands of pale setae interrupted medially; clypeus shining, with distinct larger punctures; body length ca. 10–12 mm) (Arizona, New Mexico) ..... sp. 179

— Pseudopygidial area variable, but if setae nearly uniform then appearing dark brown, or if nearly uniform pale golden brown then apical margin of pseudopygidial area rounded 122

122(121). Pseudopygidial area longitudinally elongate and triangular to subquadrate, with narrow, basal, V-shaped region of shining setae, and straight apical margin (Fig. 391) (clypeus distinctly flat in profile, shining, black, and often contrasted with red scape, pedicel, F1, and labrum) (Arizona and New Mexico south to Durango and Baja California) ... sp. 74

— Pseudopygidial area variable, but if triangular, then not longer than wide, or with silvery setae on basal third 123

123(122). Pseudopygidial area triangular, with relatively long, coarse setae (Fig. 387) (paramedian band joined laterally to pale yellow setae on anterior margin of scutum; Arizona, Colorado, New Mexico) ..... sp. 63

— Pseudopygidial area variable but if triangular, then not nearly the same length as width, and lacking long, coarse setae on apical half 124

124(123). Pseudopygidial area distinctly longer than wide, quadrate to subtriangular, with silvery setae on basal third to half forming triangular shape (posterior margin of region of silvery setae mostly straight) (Fig. 287); clypeus shining, black (often with red apical margin), strongly contrasting with bright orange scape (mesepisternum with short, sparse, erect, simple setae) (southwestern and midwestern U.S. and northern Mexico) ..... *T. norae*

—Pseudopygidial area variable, but if with silvery setae on basal third to half, then these setae forming semicircular crescent rather than nearly triangular region; clypeus variable (sometimes exactly as described above) 125

125(124). Pseudopygidial area with silvery setae strongly differentiated from dark, coarse setae, with silvery setae extending along lateral margins of pseudopygidial area, enclosing or nearly enclosing medioapical circular region of dark, coarse setae (Figs. 406 and 427) 126

— Pseudopygidial area with setae variable but if with silvery and dark setae segregated into distinct regions, then region of dark setae not so perfectly circular 127

126(125). Clypeus shining, with distinct larger punctures (sometimes sparsely covered with white setae); scape bright orange (rarely brown); T1–4 with transverse bands of pale setae uninterrupted medially, or only T1–2 interrupted by 0.5 OD or less (southwestern U.S. and northern Mexico) ..... sp. 95

— Clypeus mostly obscured by white setae; scape brown; T1–2 with transverse bands of pale setae medially interrupted, those of T1 interrupted by nearly 1 OD (Coahuila) ..... sp. 177

127(125). Pseudopygidial area ca. as long as wide, bordered on all margins by silvery setae enclosing median patch of dark, coarse setae (Fig. 289) .. 128

— Pseudopygidial area variable but not distinctly bordered on all margins with silvery setae 129

128(127). T1–4 with transverse bands of pale setae relatively broad (ca. 2 OD in length), uninterrupted or barely interrupted medially on T1; axillar spines almost reaching posterior margin of scutellum and apically incurved; mesepisternum with punctures minute and nearly contiguous (Colorado and Idaho to Kansas and North Dakota) ..... *T. occidentalis*

— T1–4 with transverse bands of pale setae relatively narrow (ca. 1.5 OD or less), interrupted medially on T1; axillar spine reaching midpoint of scutellum or nearly so; mesepisternum punctures separated by up to 0.5 puncture diameter (Arizona and New Mexico) ..... sp. 95 (in part)

129(127). Dorsal aspect of body with bands of setae white ..... *T. michiganensis*

— Dorsal aspect of body with bands of setae yellow to pale yellow 130

130(129). All metasomal terga with transverse bands of pale setae uninterrupted medially 131

— At least T1 with transverse band of pale setae medially interrupted 132

131(130). Clypeus shining, with distinct larger punctures; T2 with lateral longitudinal band of pale setae forming strongly acute angle with apical transverse band of pale setae; paramedian band joined laterally to diffuse pale setae on anterior margin of scutum, or scutum entirely covered with diffuse pale setae ..... sp. 59

— Clypeus matte, lacking or with vague larger punctures; T2 with lateral longitudinal band of pale setae forming weakly acute angle with apical transverse band of pale setae; paramedian band distinct or (rarely) joined laterally to pale setae on anterior margin of scutum ..... *T. helianthi*

132(130). Mesepisternum mostly asetose except for patches of pale setae below scrobal groove and near pronotal lobe (mesepisternum very densely punctate) ..... *T. cressonii*

— Mesepisternum with pale setae more widely dispersed across dorsal third to half of sclerite 133

133(132). Hypoepimeron mostly covered with pale setae (sometimes this pale setae slightly sparser than those on rest of dorsal half of mesepisternum) 134

— Hypoepimeron mostly covered with dark brown or black setae 136

134(133). Paramedian band joined laterally to pale setae on anterior margin of scutum ..... sp. 59 (in part)

— Paramedian band distinct 135

135(134). Mesepisternum with medioventral spot of brown, branched setae ..... *T. townsendi*

— Mesepisternum entirely covered with diffuse, pale yellow setae ..... sp. 97

136(132). All metasomal terga with apical transverse bands interrupted medially (antennae entirely brown; legs orange except front leg with brown patches; mesepisternum usually with sparse, short, erect, simple setae) .. *T. medusa*

— Metasomal terga with transverse bands of pale setae uninterrupted medially on at least T4 137

137(136). Pseudopygidial area quadrate, with weakly differentiated region of shining setae forming relatively narrow U shape along margins of area (on ca. basal fourth or less of area) (mesepisternum shining beneath pale setae) ..... *T. laticaudus*

— Pseudopygidial area rounded, often slightly longitudinally ovate, with weakly differentiated region of shining setae more broadly covering basal third or half of area 138

138(137). T1 with basal and apical transverse bands of pale setae parallel along most of width, enclosing relatively narrow interspace (ca. 2 OD in length or little more) ..... *T. helianthi*

— T1 with basal and apical transverse bands not parallel or only parallel medially, enclosing widely quadrate or subtriangular interspace (ca. 3–4 OD in length) ..... *T. laticeps*

139(3). Mesepisternum with erect, simple setae ..... sp. 11

— Mesepisternum lacking erect, simple setae 140

140(139). Mesepisternum with minute, contiguous punctures; scutum with anterior fourth covered by dense, yellow, appressed, plumose setae, thus paramedian band of setae mostly indistinct (Fig. 216); T1 interspace usually reduced to small rectangular or circular black region; T2 with wide lateral longitudinal band of pale setae, and remaining basal region of black setae semicircular (or sometimes rectangular) ..... *T. concavus*

— Mesepisternum with small punctures, mostly separated by 1 puncture diameter or more, integument between shining; scutum lacking dense, appressed, plumose, pale setae along anterior margin, paramedian band of setae distinct; T1 interspace widely rectangular to subrectangular; T2 with lateral longitudinal band of pale setae relatively narrow, forming acute angle with apical transverse band of pale setae ..... *T. penicilliferus*.

KEY TO MALE AND FEMALE *TRIEPEOLUS* OF THE EASTERN UNITED STATES (EAST OF THE MISSISSIPPI RIVER) AND EASTERN CANADA

1. Dorsal aspect of body with pale grey-white banding 2

— Dorsal aspect of body with pale to strong yellow banding 11

2(1). Preoccipital carina strong on gena and dorsal margin of head (Fig. 283); scutum lacking paramedian band of pale setae (scutum anteriorly and pronotal collar with diffuse, erect white setae, Fig. 278) ..... *T. nigrihirtus*

— Preoccipital carina absent on dorsal margin of head, but at least partially present on gena; scutum rarely lacking paramedian band of pale setae 3

3(2). Mesepisternum with long (at least 1 OD in length), erect, simple setae ... 4

— Mesepisternum lacking erect, simple setae or with such setae less than 0.5 OD in length 6

4(3). Clypeus surpassing lower tangent of compound eyes by at least 1.5 OD (Fig. 231); female pseudopygidial area with basal crescent of shining silver setae; female and male scutum with paramedian band present 5

— Clypeus with apical margin below lower tangent of compound eyes by less than 1 OD; female pseudopygidial area uniformly shining silver (Fig. 209); female scutum lacking paramedian band, male scutum with paramedian band narrow and short ..... *T. brittaini*

5(4). Mesepisternum with integument between punctures rugose, tuberculate (Fig. 318); body length ca. 8.5–10 mm ..... *T. rugosus* (male unknown)

— Mesepisternum with integument between punctures relatively flat; body length ca. 10–13 mm ..... *T. donatus*

6(3). Pseudopygidial area with apical margin concave (Fig. 435) (clypeus lacking midline and distinct larger punctures; axillar spines reaching or exceeding scutellar midpoint, pointed apically; male pygidial plate relatively wide and triangular) ..... *T. obliteratus*

— Pseudopygidial area with apical margin weakly or strongly convex 7

7(6). Clypeus lacking midline; axillar spine often rounded apically, not or barely reaching scutellar midpoint; pseudopygidial area with apical margin strongly convex, entire area distinctly circular (Fig. 455); female S5 strongly downcurved; male pygidial plate narrow (ca. 1 OD in width), almost parallel-sided ..... sp. 101

— Clypeus with weak to strong midline; axillar spines pointed apically, nearly reaching or surpassing scutellar midpoint; pseudopygidial area with apical margin weakly to moderately convex, entire area not so distinctly circular; female S5 not or moderately downcurved; male pygidial plate not as narrow (ca. 1.5 OD in width or more), but sometimes almost parallel-sided 8

8(7). Legs distally and tegula usually orange; body length ca. 8–9 mm; clypeus with strong midline; pseudopygidial area subquadrate to subovate, apical margin weakly convex (Fig. 269); male pygidial plate nearly parallel-sided ..... *T. michiganensis*

— Legs and tegula usually brown but sometimes red; body length ca. 10–13 mm; clypeus with strong to moderate midline; pseudopygidial area longitudinally ovate, apical margin moderately convex; male pygidial plate nearly parallel-sided to subtriangular 9

9(8). Clypeus flattened, with strong midline; mesepisternum with punctures separated by only 0.5 puncture diameter or less, integument between punctures raised, somewhat tuberculate; female S5 moderately downcurved; pseudopygidial area with elongate basal silvery region (Fig. 201); female paramedian band not reaching anterior margin of scutum ..... *T. atripes*

— Clypeus convex in profile, with weak midline; mesepisternum with punctures separated by up to 1 puncture diameter, integument relatively flat between punctures; female S5 weakly downcurved; pseudopygidial area with less elongate basal silvery region; female paramedian band reaching anterior margin of scutum 10

10(9). T1 interspace widely ovate (Fig. 242) ..... *T. georgicus*

— T1 interspace subtriangular (Fig. 272) ..... *T. mitchelli* (female unknown)

11(10). Mesepisternum with long (ca. 1 OD or greater), erect, simple setae 12

— Mesepisternum lacking erect, simple setae or with such setae shorter than 0.5 OD 13

12(11). Clypeus with relatively weak midline; female scutum lacking paramedian band, male scutum with paramedian band narrow and short;

pseudopygidial area uniformly shining silver, small and triangular (Fig. 209); female mesepisternum with punctures separated by up to 2 puncture diameters ..... *T. brittaini*

— Clypeus with strong midline; female and male scutum with paramedian band present; pseudopygidial area subovate to subquadrate, with distinct basal silvery crescent (Fig. 295); female mesepisternum with punctures separated by up to 4–5 puncture diameters (Fig. 296) ..... *T. pectoralis*

13(12). Paramedian band indistinct from diffuse yellow setae on anterior third or fourth of scutum (Fig. 216); mesepisternum and scutum with fine, nearly contiguous punctures; T2 with basal black region semicircular to slightly quadrate (Fig. 217); female S5 very strongly downcurved; pseudopygidial area with long, erect setae forming rounded, three-dimensional posterior structure (Fig. 214) (male ventral metasoma entirely black or occasionally with white setae laterally on S3) ..... *T. concavus*

— Paramedian band of pale setae on scutum usually distinct, sometimes connected laterally to diffuse yellow setae on anterior of scutum [if as above, then scutum shining, with punctures spaced up to 2 puncture diameters apart in females, up to 1 puncture diameter apart in males (*T. remigatus*)]; T2 basal black region variable but not semicircular; female S5 rarely strongly downcurved; pseudopygidial area variable but lacking long, erect setae forming rounded, three-dimensional posterior structure 14

14(13). T1 mostly covered with appressed yellow setae except for small diamond, ovate, or rectangular patch of black setae mediobasally (Fig. 228) (pseudopygidial area rectangular, with setae uniformly very dense and short, setae at apical margin reflecting silver, apical margin straight, Fig. 229; axillar spine exceeding posterior margin of scutellum, apically incurved, often red) ..... *T. distinctus*

— T1 interspace not reduced as above, or if reduced to small patch black setae then either paramedian bands connected laterally to pale setae on anterior margin of scutum forming distinct anchor pattern on scutum (*T. remigatus*) or pronotal collar nearly 2 OD in length (*T. quadrifasciatus atlanticus*) 15

15(14). Pronotal collar with dorsal length ca. 2 OD (Fig. 199); paramedian band of pale setae distinct, often reduced in width and length (pseudopygidial area lacking distinctly differentiated basal region of silvery shining setae) ..... *T. q. atlanticus*

— Pronotal collar with dorsal length only ca. 1 OD or little more or less (if nearly 2 OD, then paramedian band laterally contiguous with yellow setae on anterior margin of scutum) 16

16(15). Pseudopygidial area triangular, with apical margin concave (Figs. 437 and 441); female S5 straight in profile, with bristle-like setae on apical margin; male pygidial plate lacking distinct transverse basal ridge (clypeus of both sexes lacking midline) 17

— Pseudopygidial area variable, but with apical margin weakly to strongly convex; S5 shape in profile variable but lacking dense bristle-like setae on apical margin; male pygidial plate with distinct transverse basal ridge (however, male of *T. micropygius* unknown) 18

17(16). T2 with lateral longitudinal bands of pale setae absent or reduced, if reduced then lateral band of setae forming 90 degree angle with apical transverse band of pale setae; T1 interspace rectangular to subtriangular (Fig. 440); male S4 only with apical fringe of setae, S5 apical setae distinctly shorter than those on S4 ..... *T. simplex*

— T2 with lateral longitudinal bands of pale setae forming acute angle with apical transverse band of pale setae; T1 interspace widely ovate (Fig. 436); male S4–5 with apical fringes of setae ..... *T. rhododontus*

18(16). Scutum with dense yellow setae on entire anterior margin (Fig. 278); female T5 usually lacking pale setae lateral to pseudopygidial area or with these setae restricted to apical margin of T5 (female and male scutum shining; T2 with lateral longitudinal bands of pale setae forming 90 degree angle with apical transverse band of pale setae) ..... *T. nevadensis*

— Scutum usually lacking dense yellow setae on anterior margin of scutum, orif present then at least space between paramedian bands of pale setae lacking such yellow setae; female T5 with pale setae lateral to pseudopygidial area along most of pseudopygidial area length 19

19(18). Scutum with paramedian band of setae joined laterally to pale yellow setae on anterior margin, forming strong anchor-shape of black setae on disc of scutum (Fig. 305) (T1 interspace often reduced to diamond or ovate region; T2 with lateral longitudinal bands of pale setae forming obtuse angle with transverse apical band of pale setae; pseudopygidial area setae uniformly shining golden brown, lacking distinct basal region of differentiated setae, Fig. 306) ..... *T. remigatus*

—Scutum with paramedian band of setae distinct from other pale setae on scutum, not forming strong anchor-shape of black setae on disc of scutum 20

20(19). T1 interspace widely rectangular with sinuate basal and apical transverse bands of pale setae (Fig. 275); body length ca. 15–18 mm; integument entirely black; (axillar spine pointed, reaching posterior margin of scutellum; pseudopygidial area ovate, with uniformly darkly shining setae on entire area, Fig. 276) ..... *T. monardae*

— T1 interspace widely ovate or triangular; body length less than 16 mm, usually ca. 9–15 mm; integument usually with at least some orange or red areas, especially on labrum, antennae, and/or legs 21

21(20). Scutellum entirely or partially red; scutum usually red but sometimes only partly red; paramedian band absent or relatively short (Figs. 312 and 313), not reaching anterior margin of scutum ..... *T. rufithorax*

— Scutellum and scutum black; paramedian band variable, very rarely absent 22

22(21). T1 interspace triangular (Fig. 260) ..... *T. lunatus*

— T1 interspace widely ovate 23

23(22). Pseudopygidial area round and small, basal third with fine, silvery setae strongly contrasting with circular apical region of coarse setae (Fig. 271); S5 strongly downcurved ..... *T. micropygius* (male unknown)

— Pseudopygidial area subtriangular to subquadrate, with basal silvery setae absent or present; S5 not or only weakly downcurved 24

24. T1 and T2 only (rarely also other terga) with transverse bands of pale setae medially interrupted (Fig. 246); pseudopygidial area with setae mostly uniform in reflectance, density, and texture; shape of area typically longitudinally ovate (Fig. 247); male clypeus with apical fourth asetose ..... *T. helianthi*

— T1–4 usually with transverse bands of pale setae medially interrupted (Fig. 218); pseudopygidial area with distinct basal crescent of shining setae; shape of pseudopygidial area typically more longitudinally elongate, subtriangular to subquadrate (Fig. 219); male clypeus entirely covered with white setae ..... *T. cressonii*.

KEY TO MALE AND FEMALE *TRIEPEOLUS* FROM SOUTH AMERICA & THE CARIBBEAN

1. Body length ca 16 mm or more; mesepisternum with long, erect, simple setae (axillar spine surpassing posterior margin of scutellum, sharply pointed, incurved) (Caribbean) 2

— Body length ca.14 mm or less; mesepisternum lacking or with very short, erect, simple setae (except *T. atoconganus*, from Ecuador and Peru, with long setae) 3

2(1). T1 lacking basal transverse band of pale setae, with apical transverse band of pale setae uninterrupted or only slightly interrupted medially (Fig. 346); T2–4 with apical transverse bands of pale setae uninterrupted medially (Dominican Republic) ..... *T. victori*

— T1 with basal and apical transverse bands of pale setae interrupted medially; T2–4 with apical transverse bands of pale setae interrupted medially (Fig. 348) (Cuba) ..... *T. wilsoni*

3(1). At least scutellum bright red, shining (T2–3 with apical transverse bands of pale setae interrupted medially, Fig. 448) (Caribbean, South America) ..... *T. osiriformis*

— Scutellum black (or, if red, then T2–3 with apical transverse bands of pale setae not interrupted medially) 4

4(3). T1 lacking transverse apical band of yellow or white setae 5

— T1 with transverse apical band of yellow or white setae 6

5(4). Paramedian band reaching anterior margin of scutum, tapering anteriorly; T2 with transverse apical band of yellow setae at least slightly interrupted medially; male S3 with pale apical setae surpassing apical margin (female unknown) (Colombia) ..... *T. flavipennsis*

— Paramedian band of scutum short, well separated from anterior margin, not tapering anteriorly; T2 with transverse apical band of pale setae not interrupted medially; male S3 with pale apical setae not surpassing apical margin (female pseudopygidial area concave apically, with stout lateral setae) (Brazil) ..... *T. alvarengai*

6(4). At least T2–3 with transverse apical bands of pale setae not interrupted medially (Fig. 315) (Caribbean, Mexico) ..... *T. rufoclypeus*

— At least T2–3 with transverse apical bands of pale setae interrupted medially 7

7(6). Vertex and upper mesepisternum with dense, erect setae (Peru) .... *T. atoconganus*

— Upper mesepisternum lacking erect setae; vertex with erect setae mostly limited to small patch posterior to ocelli 8

8(7). Axillar spine triangular, with free apical point only ca. 0.25 total length 9

— Axillar spine pointed, with free apical point ca. 0.5 or more total length 10

9(8). T2 with lateral longitudinal band of pale setae; vertex between lateral ocellus and compound eye with punctures nearly contiguous; T1 with pale lateral setae (Fig. 446) (Ecuador, Peru) 14

— T2 lacking lateral longitudinal band of pale setae; vertex between lateral ocellus and compound eye with punctures separated by up to one puncture diameter; T1 with pale lateral setae lacking (Caribbean) or sometimes present (Fig. 450) (Colombia, Venezuela) ..... *T. rufotegularis*

10(8). T1 interspace strongly rectangular at lateral corners (Fig. 438); pseudopygidial area with elevated subapical arch, apical margin weakly concave, often appearing to have small median notch on apical margin formed by part in setae (Fig. 439) (Caribbean) ..... *T. roni*

— T1 interspace widely ovate, lacking distinct angular corners laterally; pseudopygidial area lacking elevated subapical arch, apical margin straight or convex 11

11(10). Mesepisternum mostly covered with dense, yellow or white, plumose setae, except for circular dark region medioventrally (Caribbean) 12

— Mesepisternum with dense, white, plumose setae dorsally, mostly asetose ventrally, lacking distinct circular dark region (Venezuela) ..... sp. 169

12(11). Dorsal margin of head with strong median notch (Fig. 285) (female unknown) ..... *T. nisibonensis*

— Dorsal margin of head evenly, weakly concave, lacking median notch .. 13

13(12). Anterior surface of antenna (directed dorsally) entirely orange; body length 5–6 mm; pseudopygidial area subrectangular, with apical tuft of shining setae (Fig. 221) ..... *T. cuabitensis*

— Antenna orange or reddish basal to F2, brown apically; body length ca. 9–12 mm; pseudopygidial area subtriangular, with vague basal crescent of shining setae (Fig. 345) ..... *T. vicinus*

14(9). T1 with basal transverse bands of pale setae medially interrupted by more than 2.25 OD; body length ca. 9–13 mm, width between tegulae ca. 1.9–2.3 mm ..... *T. buchwaldi*

— T1 with basal transverse bands of pale setae medially interrupted by less than 2 OD; body length ca. 7.5–10 mm, width between tegulae ca. 1.6–1.8 mm ..... *T. aguilari*.

TRIEPEOLUS DESCRIPTIONS AND SUPPLEMENTAL DATA

This section provides the taxonomic history of all of the named species of *Triepeolus*. In addition, for most of the species, it provides a brief description, comments, geographical range, host and plant data (if known), seasonal records, and the number of specimens examined in this study, with the specimen repositories in parentheses listed after. The specimen repositories are listed by the city in which the repository is found. A complete listing of these repositories is in the Materials section.

The following species are found under the *Triepeolus simplex* group heading (p. 337):

T. alvarengai Moure
T. kathrynae Rozen
T. mexicanus (Cresson)
T. obliteratus (Graenicher)
T. rhododontus Cockerell
T. roni Genaro
T. simplex Robertson
(undiagnosed species names):
T. lectiformis
T. sarothrinus.

The following species are found under the *Triepeolus verbesinae* group heading (p. 355):

T. aguilari Moure
T. atoconganus Moure
T. bilineatus Cockerell
T. buchwaldi (Friese)
T. flavipennsis (Friese)
T. osiriformis (Schrottky)
T. rufotegularis (Ashmead)
T. verbesinae (Cockerell)
sp. 101
sp. 169
sp. 172
(undiagnosed species names):
T. ancoratus Cockerell
T. callopus Cockerell
T. custeri Cockerell
T. cyclurus Cockerell
T. grindeliae Cockerell
T. haematurus Cockerell & Sandhouse
T. timberlakei Cockerell
T. timberlakei heterodoxus Cockerell.

The following names are unplaced within this taxonomic treatment (p. 378):

T. bihamatus (Cockerell)
T. blaisdelli (Cockerell)
T. brunnescens Cockerell & Sandhouse
T. cuneatus Cockerell
T. hopkinsi Cockerell
T. inyoensis Cockerell & Sandhouse
T. isocomae Cockerell
T. lusor Cockerell
T. mensae Cockerell
T.? *mercatus* (Fabricius)
T. nemoralis (Holmberg)
T. occidentalis segregatus Cockerell
T. permixtus (Cockerell)
T. pomonalis Cockerell
T. saturninus Cockerell & Sandhouse
T. scelestus tubercularis Brues
T. schwarzi Cockerell
T. schwarzi subcalens Cockerell & Sandhouse
T. sequior Cockerell.

All other valid names are found in alphabetical order by species, or in the case of *T. quadrifasciatus atlanticus*, by subspecies, below. In addition, several species are described which have not yet been associated with previously published names. It is likely that many of these represent new species; however, a more detailed study of the males of this genus needs to be completed before their status can be confidently ascertained. These as yet unnamed species are listed by number.

In the taxonomic histories below, details of the primary type specimens are presented in brackets. Additional information regarding the types is found in parentheses within the brackets; for example, if plant data, or a more precise collecting date, is given in the original publication but is not found on the physical type label itself, then such data are provided in parentheses.

Unless otherwise specified, characteristics of the species described below refer to both genders. For each species, the listing of specimens examined and

their repositories includes the primary type for that species unless I indicate that I have not seen it.

TRIEPEOLUS ANTIGUENSIS COCKERELL

(Figs. 192, 193)

Triepeolus antiguensis Cockerell 1949: 460 [Holotype: U. S. National Museum of Natural History No. 58537; ♂, Antigua (Sacatepéquez), Guatemala; December 26].

Description.—Length ca. 9–11 mm; ITW 1.6–2.5 mm. Integument black, with red on part of mandible; orange on F1, tibiae, and tarsi (excluding spurs), sometimes on labrum, scape, pedicel, and part of legs basal to tibiae (specimen from Mexico); and pale orange-brown on tegula; dorsally with bands of setae orange-yellow. Clypeus with elevated midline, with very faint larger punctures laterally, sometimes covered with diffuse white setae (much denser in males). Face dorsally and mesepisternum with erect, simple setae (erect setae on most of head and mesosoma). Mesepisternum covered with long, pale, minutely-branched, suberect to erect setae (sparser medioventrally and on hypoepimeron); punctures deeply impressed, nearly contiguous to separated by up to a puncture diameter. Paramedian bands distinct. Scutellum weakly to moderately bigibbous; axillar spines not reaching midpoint of scutellum. T1 sometimes lacking lateral longitudinal band of yellow setae (especially in specimens from Guatemala and Costa Rica); T1 interspace widely ovate to subquadrate, apical transverse band of yellow setae widely interrupted medially; T2 with lateral, longitudinal band of

pale setae absent or forming acute angle with apical transverse band of yellow setae. Female: Pseudopygidial area semicircular, basally with distinct crescent of finer, denser setae; S5 straight in profile. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and apical downturned plate; S4–5 with apical fringes of setae golden brown and white laterally; S2–3 with apical bands white, grading into sparser white setae basally (S3 with white setae slightly extended past apical margin).

Comments.—This species has two forms. One is found from Chiapas south to Costa Rica, and lacks the lateral, longitudinal band of pale setae on the T1; the other is found from Chiapas north to Hidalgo, and has the lateral, longitudinal band of pale setae on the T1. In addition, these two forms appear to be active in different seasons. In all other respects the two forms are very similar, including the erect, simple and branched setae of the mesepisternum, the medially interrupted apical transverse bands of setae on the T1 and T2, the distinct paramedian bands, the coloration of the legs, and the type of pseudopygidial area. Further evidence may support segregating these two kinds into distinct species.

Distribution.—COSTA RICA: Heredia, Puntarenas, San José; GUATEMALA: Sacatepéquez; MEXICO: Chiapas, Durango, Hidalgo, Michoacán, Morelos, Puebla.

Seasonal Records.—July 20 to September 18 (northern form); December 16 to March 12 (southern form).

Specimens examined.—7 ♀, 1 ♂ (BERKELEY, HEREDIA, LAWRENCE, LOGAN, WASHINGTON D.C.)

TRIEPEOLUS ARGYREUS COCKERELL

(Figs. 194, 195)

Triepeolus argyreus (Cockerell) 1907c: 60–61 [Holotype: U. S. National Museum of Natural History No.100019; ♂, North Yakima, Washington; August 4 1903].

Description.—Length ca. 9–12 mm, ITW 1.5–2.5 mm. Integument black, with orange usually on F1, sometimes on labrum and part or entire legs (excluding basal coxae and spurs); dorsally with relatively broad bands of very pale yellow setae. Clypeus lacking or with midline dorsally, with distinct larger punctures. Mesepisternum with long, erect, simple setae, dorsal half with dense, pale yellow, branched setae, ventral half with similar, but less dense setae, or with brown, branched setae; medially with punctures nearly contiguous to separated by 0.5 puncture diameter, with integument between punctures raised, tuberculate. Paramedian bands intermixed with sparse white setae on anterior scutum, sometimes poorly distinguished from them. Scutellum weakly bigibbous; axillar spines triangular, not reaching midpoint of scutellum, sometimes with apical point rounded. T1 interspace widely rectangular, sometimes reduced to smaller black region medially; T2 with lateral, longitudinal band of pale setae forming 90 degree angle with apical, transverse band of pale setae. Female: Pseudopygidial

area semicircular to subquadrate, with distinct basal silvery crescent; S5 slightly downcurved apically. Male: Unknown.

Comments.—This species resembles *T. eldoradensis* and *T. paenepectoralis* due to the presence of long, erect, simple setae on the mesepisternum, the 90 degree angle formed by the lateral and apical bands of pale setae on the T2, the distinct basal shining crescent on the pseudopygidial area, and the relatively short face. Due to these similarities, *T. paenepectoralis*, *T. eldoradensis*, and *T. argyreus* are grouped together in a group here termed the "*T. paenepectoralis* species group." See Table 4 for potentially differentiating characteristics of these species.

Distribution.—USA: California, Idaho, Nevada, Oregon, Washington.

Host Records.—*Melissodes* (*Eumelissodes*) *pallidisignata* Cockerell (1 female specimen reared from cell by E. Miliczky; 11 females captured from nest site, in Yakima Co., Washington)

Floral Records.—*Chrysothamnus nauseosus* [= *Ericameria nauseosa* (Pallas ex Pursh) Nesom & Baird], *Hemizonia pugens* (Hook. and Arn.) Torrey and Gray, *Machaeranthera canescens* (Pursh) Gray, *Melilotus* sp.

Seasonal Records.—July 4 to September 20

Specimens examined.—25 ♀ (CORVALLIS, DAVIS, GAINESVILLE, LOS ANGELES, SAN FRANCISCO, WASHINGTON D.C., ZILLAH)

Table 4. Characterization of the species within the *Triepeolus paenepectoralis* species group.

	T. eldoradensis	*T. argyreus*	*T. paenepectoralis*
Leg color	pale orange	brown to black (rarely orange)	brown to black
Mesepisternum	covered with pale yellow, appressed, plumose setae	covered with pale yellow, appressed, plumose setae or with pale setae restricted dorsally	pale yellow, appressed, plumose setae usually restricted dorsally, rarely covering most of mesepisternum
Scutum	mostly covered with pale yellow setae, obscuring submedian band of setae	submedian band of setae mostly distinct, but often surrounded by diffuse pale yellow setae, esp. anteriorly	submedian band of setae distinct, often reduced, or sometimes connected to lateral setae
Scutellum	mostly covered with pale yellow setae	sometimes covered with pale yellow setae	not covered with pale setae
T1 transverse bands of pale setae	continuous medially	continuous medially	continuous or interrupted medially
Pseudopygidial area	basal and apical setae usually poorly differentiated	basal and apical setae usually well differentiated	basal and apical setae usually well differentiated
Distribution	Colorado, Idaho, Utah, Wyoming	California, Idaho, Nevada, Oregon, Washington	Alberta, British Columbia, California, Colorado, Idaho, Nevada, Oregon, Utah, Washington, Wyoming

TRIEPEOLUS QUADRIFASCIATUS ATLANTICUS MITCHELL

(Figs. 196–199)

Triepeolus quadrifasciatus atlanticus Mitchell 1962: 479–480, Fig. 112 [Holotype: U. S. National Museum of Natural History No. 400194 (on indefinite loan from North Carolina State University); ♀, Bogue (Carteret Co.), North Carolina; August 31 1933; *Monarda punctata*].

Description.—Length ca. 14–16mm; ITW 3mm; rarely as small as length 12mm, ITW 2.5mm. Integument black, with red on part of mandible, labrum,

apical margin of clypeus (usually), scape, pedicel and F1, pronotal lobe, tegula, and legs distal to coxae (spurs black); dorsally with bands of setae yellow to pale yellow. Clypeus with integument shining, asetose to sparsely covered with golden setae (more densely covered in males), lacking midline, and with distinct larger punctures. Mesepisternum lacking erect, simple setae; with white, appressed, branched setae dorsally and sometimes posteroventrally; ventral half to three-fourths with brown, appressed, branched setae or asetose; ventral half of mesepisternum with punctures small, separated by up to a puncture diameter (usually less); integument between punctures raised, slightly tuberculate. Pronotal collar long (ca. 2 OD in length), especially medially. Scutum shining with paramedian bands distinct and narrow or absent. Axillar spine pointed, surpassing scutellum midpoint (or very rarely reaching midpoint), curving slightly inward apically; scutellum somewhat flattened and extended posteriorly. T1 almost entirely covered with yellow setae except for black longitudinal line medially and often small black oval, triangle, or large rectangle medially; T2 with pale lateral setae absent or rarely present but very reduced (forming 90 degree angle with apical setae). Female: Pseudopygidial area subquadrate, covered with darkly shining, coarse setae, these setae very slightly sparser, more erect, and longer on apical half to three-fourths; S5 slightly downcurved apically; metasomal venter brown, with lateral patches of white setae on S2–4 (sometimes extending across entire S3 apical margin; usually faint on S4). Male: Pygidial plate relatively wide, with distinct basal transverse ridge; S4–5 with dark brown apical

fringes, contrasting with white apical setae laterally or on entire apical margin of S2–3 (S4 sometimes with small patch white setae on apicolateral margin).

Comments.—The subspecies *T. q. atlanticus* has the T1 black interspace commonly represented by a longitudinal line with a median triangular or subovate region. It is rarely found as a longitudinal line only, or is present as a strongly rectangular area. Specimens from St. Louis, Missouri, range from the T1 interspace perfectly longitudinally linear, to linear with a small ovate black patch medially, to strongly rectangular medially; thus, the shape of the T1 interspace is not always consistent for delineating the subspecies of *T. quadrifasciatus*, especially at this point in their respective distributions, where the two subspecies may be interbreeding. However, a consistent character is found in the coloration of the face: *T. q. atlanticus* differs from *T. q. quadrifasciatus* by the coloration of clypeus and interantennal area, which is entirely red and strongly delineated from the black lateral areas of the face in *T. q. quadrifasciatus*. In *T. q. atlanticus*, the clypeus is either entirely black or black with red on the apical margin.

Distribution.—USA: Alabama, Florida, Georgia, Illinois, Maryland, Mississippi, Missouri, New Jersey, North Carolina, Virginia.

Host Records.—*Svastra* (*Epimelissodes*) *atripes atrimitra* (LaBerge) (3 specimens from nesting site, in Alabama; and Cane, 1995, adults inspecting and entering host nests).

Floral Records.—*Bidens pilosa* L., "white goldenrod" (= *Solidago bicolor* L.).

Seasonal Records.—June 30 to September 19.

Specimens examined.—23 ♀, 24 ♂ (BERLIN, CORVALLIS, GAINESVILLE, ITHACA, LAWRENCE, LOS ANGELES, NEW YORK, STARKVILLE, URBANA, WASHINGTON D.C.).

TRIEPEOLUS ATRIPES MITCHELL

(Figs. 200, 201)

Triepeolus micropygius atripes Mitchell 1962: 474, Fig. 112 [Holotype: U. S. National Museum of Natural History No. 75245; ♀, Holly Shelter (Pender Co.), North Carolina; October 18 1952].

Description.—Length ca. 10–13 mm; ITW 2.0–2.5 mm. Integument black, with red on part of mandibles and sometimes F1; dorsally with bands of setae pale grey to white. Clypeus relatively flat, with strong midline; integument entirely covered with white, medially-directed setae, or partially or entirely asetose, with no or very vague larger punctures. Mesepisternum lacking erect, simple setae; punctures irregular and fairly dense (separated by up to 2, sometimes 3, puncture diameters); integument between punctures raised and shining. Paramedian bands distinct (females and some males) or connected laterally to diffuse white setae on anterior margin of scutum (some males). Scutellum moderately to strongly bigibbous, axillar spines triangular, reaching or surpassing midpoint of scutellum, sometimes weakly incurved apically. T1 interspace widely ovate; T2 with lateral bands of pale setae forming weakly acute

angle with transverse apical band of pale setae. Female: Pseudopygidial area longitudinally ovate, with elongate, somewhat elevated basal crescent of silvery shining setae; S5 weakly to moderately downcurved in profile; S3–4 with lateral bands of white setae on apical margins. Male: Pygidial plate of moderate size, weakly keyhole shaped, with weak basal transverse ridge; S4–5 with brown apical fringes of setae; S2–3 with apical bands of white setae (S4 sometimes with small patch of white setae on apicolateral margin).

Comments.—This species strongly resembles *T. georgicus*, but in *T. atripes* the clypeus is flattened and has a strong midline, the mesepisternum is more densely punctured and the integument between the punctures is raised and slightly tuberculate in appearance, and in the females, the paramedian bands do not reach the anterior margin of the scutum, the pseudopygidial area has an enlarged basal crescent of shining setae and the S5 is slightly more downcurved. *Triepeolus atripes* is also similar to *T. donatus* and *T. rugosus*, but unlike the latter two species, *T. atripes* has a normal length face and lacks the long, erect, simple setae on the mesepisternum.

There are two female specimens from Pennsylvania, Coleman Park, that were identified as *T. atripes* by Mitchell (one is a paratype); however, I tentatively identify these specimens as *T. cressonii*, albeit with somewhat paler than usual yellow banding. *Triepeolus atripes* can be distinguished from *T. cressonii* by the pale grey to white band coloration, and the nearly entirely black

integument (as opposed to pale yellow band coloration, usually with at least some areas of red integument on the legs and face in *T. cressonii*).

Distribution.—USA: Arkansas, Georgia, Illinois, Maryland, Mississippi, Missouri, North Carolina, New York, Pennsylvania, Texas, Virginia.

Floral Records.—*Aster lateriflorus* [= *Symphyotrichum lateriflorum* (L.) A.& D. Löve var. *lateriflorum*], *A. pilosus* [= *Symphyotrichum pilosum* (Willd.) Nesom var. *pilosum*], *Chrysopsis mariana* (L.) Ell., *C. microcephala* [= *Pityopsis graminifolia* (Michx.) Nutt. var. *tenuifolia* (Torr.) Semple & Bowers], *Helianthus* sp., and *Solidago* sp.

Seasonal Records.—July 2 to November 4.

Specimens examined.—44 ♀, 31♂ (AUSTIN, DAVIS, ITHACA, LAWRENCE, LAWRENCE-BAKER, NEW YORK, RALEIGH, SAN FRANCISCO, STARKVILLE, URBANA, WASHINGTON D.C.).

TRIEPEOLUS AZTECUS (CRESSON)

(Figs. 202–204)

Epeolus aztecus Cresson 1878: 89–90 [Lectotype: Academy of Natural Sciences No. 2238; ♀, Mexico]; Cresson 1916: 113 [designation of lectotype].

Epeolus flavocinctus Friese 1917 [1916]: 336 [Neotype: Zoologisches Museum, Humboldt-Universität; ♀, San Mateo (Alajuela), Costa Rica; 1904 (See comments below)]. **new synonymy, new neotype designation**

Epeolus costaricensis Friese 1925a: 32–33 [Lectotype: Zoologisches Museum, Humboldt-Universität; ♀, San José, Costa Rica; April 11 1903 (See comments below)]. **new synonymy, new lectotype designation**

Epeolus albopictus Cockerell 1949: 459 [Holotype: U. S. National Museum of Natural History No. 58535; ♂, San Francisco finca, near Zamorano (El Paraíso), Honduras; November 3]. **new synonymy**

Triepeolus aztecus (Cresson); Brumley 1965: 73.

Description.—Length ca. 7.5–11 mm; ITW 1.9–2.2 mm. Integument black, with red on part of mandible, orange on F1; dorsally with bands of setae yellow to pale yellow. Clypeus lacking or with very faint midline, with very faint larger punctures. Paramedian bands absent or somewhat diffuse, short, and close together medially on anterior margin of scutum. Mesepisternum lacking erect, simple setae; with punctures mostly small and nearly contiguous, but also with some areas of apunctate, raised integument (ca. 0.5 to 1 puncture width in size); dorsally with dense, pale, branched setae below scrobal groove and along posterior margin; ventrally with diffuse, brown, branched setae. Scutellum moderately bigibbous; axillar spines triangular, reaching or slightly surpassing midpoint of scutellum. T1 with pale yellow setae almost entirely covering dorsal surface, except for black longitudinal line and semicircular black spot medially on basal margin; T2 lacking lateral longitudinal band of yellow setae. Female: Pseudopygidial area subquadrate, with mostly uniform setae, with slight region of lighter reflectance basally. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and apical downturned plate; S4–5 with brown to pale

golden apical fringes of setae; S2–3 with apical bands of white setae (S3 with white setae slightly surpassing apical margin).

Comments.—At the Berlin museum there are two specimens (a male and a female) with Friese "Type" labels for *Epeolus flavocinctus*. The male specimen is from the same collection locality as in the original description (San José), but was apparently collected in 1923 and identified by Friese in 1925 (well past the publication date of 1917); in addition, the original description was of a female, and the description of the T1 does not match that of the male specimen (which actually is *Triepeolus* sp. 142). Instead, I have designated the female specimen as the neotype, despite being from the wrong (but nearby) locality, because it is the correct gender and because the distinctive T1 matches that of the original description. The female specimen cannot be part of the original type series, as the species was described based on only one female from a different locality; thus the specimen is designated as a neotype. The complete label data for this specimen are as follows: "Costa Rica, San Mateo, 1904 // *Epeolus flavocinctus* Fr. ♀ 1915 Friese det // Type [red label] // Neotype ♀ *Epeolus flavocinctus* Friese 1916 det Rightmyer 2005." Designation of a neotype is essential in order to stabilize the use of the name.

Also at the Berlin Museum, there is a series of one female and six males identified by Friese as *Epeolus costaricensis*, all from the original type locality. As the holotype specimen was not designated by Friese in the original publication, both males and females are described therein, the female specimen

bears a type label, and females are typically more readily identifiable, I am designating the female specimen as the lectotype. The complete label data for the lectotype of *Epeolus costaricensis* are as follows: "Costa Rica, San José, 4.11.1903 [the number '21' appears to be handwritten over the date 1903] // *Epeolus costaricensis* Fr. ♀ 1910 Friese det. // Type [red label] // Lectotype ♀ *Epeolus costaricensis* Friese 1925 des. M. Rightmyer 2005."

Distribution.—COSTA RICA: Alajuela, Guanacaste, San José; HONDURAS: El Paraíso; MEXICO (state unspecified).

Floral Records.—*Hibiscus rosasinensis* L.

Seasonal Records.—November 9 to December 25.

Specimens examined.—5 ♀, 2 ♂ (BERLIN, HEREDIA, LOGAN, PHILADELPHIA, WASHINGTON D.C.).

TRIEPEOLUS BALTEATUS COCKERELL

(Figs. 205–207)

Triepeolus balteatus Cockerell 1921: 5 [Holotype: American Museum of Natural History No. 25084; ♂, Denver, Colorado; August 28 1919].

Triepeolus brunneus Cockerell 1921: 7 [Holotype: American Museum of Natural History No. 25087; ♀, Lawn Lake, Rocky Mountain National Park, Colorado; 10,000 ft; August 22 1919]. **new synonymy**

Description.—Length ca. 8.5–11.5 mm; ITW 1.8–2.2 mm. Integument black, with red to orange on part of mandible and F1, entire tegula, and legs

(excluding basal coxae and spurs), sometimes on part of labrum; dorsally with bands of setae pale yellow. Clypeus with faint midline and larger punctures (females), or entirely covered with dense, white, appressed setae (males). Preoccipital carina very strongly developed along entire length of gena, outcurved. Mesepisternum with erect, simple setae, dorsally with dense, pale yellow, branched setae, grading to somewhat sparser setae ventrally; punctation irregular, integument between punctures somewhat raised and shining (females), or entirely covered by dense, white, appressed setae (males). Intercoxal area developed into clasper-like structure. Paramedian bands laterally contiguous with diffuse apical pale setae (medially, between paramedian bands, mostly asetose in females, more densely setose in males). Scutellum weakly bigibbous; axillar spines triangular, not or barely reaching midpoint of scutellum. T1 interspace widely rectangular; T2 with lateral, longitudinal band of pale setae forming 90 degree angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular (apical margin convex), with distinct, somewhat pilose, basal silvery setae; S5 moderately downcurved. Male: Pygidial plate keyhole shaped, with transverse basal ridge and downturned apical plate; S4–5 with brown and golden brown to white apical fringes of setae; S2–3 with apical bands of white setae.

Comments.—Both sexes of this species are easily recognized by the clasper-like intercoxal area, the protruding preoccipital carina, and the erect, simple setae on the mesepisternum. The distribution of this species is congruent

with the Rocky Mountains. The names *balteatus* and *brunneus* were published simultaneously. As first reviewer, I have selected the former name, which also has page priority.

Distribution.—CANADA: Alberta; USA: Colorado, Idaho, Montana, Nebraska, New Mexico, Oregon, Utah, Wyoming.

Host Records.—"*Nomia*, *Melissodes*, etc. holes" (2 female specimens from Boulder, Colorado).

Floral Records: *Chrysopsis villosa* [= *Heterotheca villosa* (Pursh) Shinners var. *villosa*], *Chrysothamnus viscidiflorus* (Hook.) Nutt., *Grindelia squarrosa* (Pursh) Dunal, *Kochia prostrata* [= *Bassia prostrata* (L.) A.J. Scott], *Solidago missouriensis* Nutt.

Seasonal Records.—July (day unspecified) to September 27.

Specimens examined.—48 ♀, 3 ♂ (BOULDER, LAWRENCE, LOGAN, NEW YORK, WASHINGTON D.C.).

TRIEPEOLUS BRITTAINI COCKERELL

(Figs. 208, 209)

Triepeolus brittaini Cockerell 1931: 279 [Holotype: Canadian National Collection No. 3358; ♂, Kings Co., Nova Scotia, Canada; July 31 1930; *Epilobium*].

Triepeolus charlottensis Mitchell 1962: 462–463, Fig. 112 [Holotype: Canadian National Collection No. 15270; ♀,Charlotte Co., New Brunswick, Canada; September 10 1956].

new synonymy

Description.—Length ca. 10 mm; ITW 1.9 mm. Integument black, with red on distal half of mandible; dorsal aspect with bands of setae pale yellow. Clypeus with faint midline, faint large punctures present (female) or lacking, covered with setae (male). Mesepisternum with sparse, long, erect, simple setae; dorsally with diffuse, pale yellow, branched setae (female), or mostly covered with pale, branched setae (male); punctation fine and somewhat irregular, punctures separated by up to 2 puncture widths in some spots (these areas elevated, shining); punctures denser in male. Paramedian bands absent (female) or diffuse, narrow (male). Axillar spines triangular, relatively small (almost reaching midpoint of scutellum in females, reaching midpoint in males); scutellum weakly bigibbous (female), or moderately bigibbous (male), somewhat extended posteriorly and sloping ventrally, rugose. T1 interspace widely rectangular to ovate, T1 with lateral pale setae mostly lacking, especially basally; T2 with lateral pale setae absent or reduced, forming 90 degree angle with transverse apical band of pale setae; banding relatively narrow on metasoma. Female: Pseudopygidial area small, triangular, with uniformly silver setae; S5 not downcurved. Mesosoma and metasoma venter lacking pale setae. Male: Pygidial plate keyhole shaped (not notched subapically), with distinct apical downturned plate and weak basal transverse ridge; S4–5 with apical fringes of setae white or a mixture of white and brown; S2–3 with apical bands of setae white, very slightly extended past apical margin on S3.

Comments.—*Triepeolus brittaini* is extremely similar to *T. subalpinus*, but the latter species has paramedian bands present on the scutum in both sexes, the metasomal banding is broader, and the mesepisternal punctation is denser. None of these characters are particularly strong, but I hesitate to synonymize *T. brittaini* with so few specimens available for examination. Further specimens of *T. brittaini* may lend support for synonymizing this name with *T. subalpinus*.

Triepeolus brittaini is also similar to *T. pectoralis* in the erect, simple setae on mesepisternum and pale yellow banding on metasoma, but *T. brittaini* females can be recognized by the punctation of the mesepisternum which is more closely spaced, the lack paramedian bands on the scutum, and the pseudopygidial area which is uniformly silver. Potential characters to separate the males of these two species include the clypeal midline, which tends to be strong in *T. pectoralis* and weak in *T. brittaini*, and the leg coloration, which tends to be more orange in *T. pectoralis*.

Distribution.—CANADA: New Brunswick, Nova Scotia.

Floral Records.—*Epilobium* sp.

Seasonal Records.—July 31 to September 10.

Specimens examined.—2 ♀, 1 ♂ (OTTAWA, RALEIGH).

TRIEPEOLUS CALIFORNICUS (CRESSON)

(Figs. 210, 211)

Epeolus californicus Cresson 1878: 86 [Lectotype: Academy of Natural Sciences No. 2219; ♀, California]; Cresson 1916: 114 [lectotype designation].

Description.—Length ca. 8–11 mm; ITW 1.9–2.5 mm. Integument black, with red on part of mandible, orange on at least tibiae and sometimes on F1; dorsally with bands of setae yellow-orange to yellow (paler yellow in males). Clypeus with midline and faint larger punctures, entirely covered with dense white setae in males. Mesepisternum lacking erect, simple setae; densely covered with yellow, branched setae. Paramedian bands distinct, rather elongate. Scutellum moderately bigibbous; axillar spines triangular, not or barely reaching midpoint of scutellum. T1 interspace entirely enclosed by yellow setae, forming very broad, parallel-sided region with rounded lateral sides and often with circular medial spot; T2 with lateral, longitudinal band of pale setae forming strongly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area subquadrate, composed of uniformly golden setae; S5 straight to very slightly downcurved in profile, sometimes with lateral patches of yellow setae. Male: Pygidial plate elongate, either lacking transverse basal ridge or with this ridge so basal on plate as to be obscured by preceding tergum; S4–5 with apical fringes of setae (brown on S5, white with brownish tinge on tips on S4); S2–3 with white apical bands of setae (S3 with white setae slightly exceeding apical margin).

Comments.—This species resembles *Triepeolus* sp. 39; see comments under that species for differentiating characters.

Distribution.—USA: California.

Floral Records.—*Eriogonum nudum* Doug. ex Benth., *Bigelovia* sp. (= *Eriameria* or *Machaeranthera* sp.?), *Hemizonia fasciculata* (DC.) Torr. & Gray.

Seasonal Records.—June 10 to September 21.

Specimens examined.—19 ♀, 6 ♂ (DAVIS, LAWRENCE, LOGAN, LOS ANGELES, PHILADELPHIA, RIVERSIDE, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS CAMERONI (MEADE-WALDO)

(Figs. 212, 213)

Epeolus bifasciatus Cameron 1907: 136 [nec. Cresson, nec. Jörgensen] [Lectotype: The Natural History Museum, London No. 17B.516; ♂ (not ♀), Mexico (see Comments, below)].

new lectotype designation

Epeolus cameroni Meade-Waldo 1913: 97–98 [replacement name].

Triepeolus cameroni (Meade-Waldo); Brumley 1965: 73.

Description.—Length ca. 8.5–10 mm; ITW 1.6–2.3 mm. Integument black, with red to orange on part of mandible, scape, pedicel, F1, tegula, and parts of legs (excluding basal coxae and spurs), sometimes on outer margins of labrum and pronotal lobe; dorsally with bands of setae orange-yellow to yellow. Clypeus lacking or with weak midline, lacking larger punctures, sometimes covered with diffuse pale setae. Pronotal collar often narrowed submedially. Mesepisternum lacking erect, simple setae; dorsally with patch of dense, branched, pale yellow setae below scrobal groove and pronotal lobe; ventrally mostly asetose, integument shining, with punctures nearly contiguous to separated by up to 2

puncture diameters. Paramedian bands distinct, not reaching or, uncommonly, barely reaching anterior margin of scutum. Scutellum moderately to weakly bigibbous, axillar spines triangular, reaching or slightly surpassing midpoint of scutellum. T1 with bands of yellow setae restricted to lateral margin or basolateral corner of tergum, sometimes with narrow transverse apical band laterally; T2 lacking lateral, longitudinal band of pale setae. Female: Pseudopygidial area subrectangular, with uniformly golden setae or with weakly differentiated basal region of denser, shinier setae; S5 straight in profile. Male: Pygidial plate keyhole shaped, with weak transverse basal ridge and apical downturned plate; metasomal sternal setae uniformly golden; S3–5 with well-developed apical fringes of setae.

Comments.—*Triepeolus cameroni* is easily confused with *T. rufoclypeus*; the names may well be synonymous but are kept distinct until more concrete evidence is obtained. The two species can be distinguished by the relative reduction of the apical transverse band of yellow setae on the T1 (more reduced in *T. cameroni*, less reduced in *T. rufoclypeus*), as well as by the collection locality (see distributions for *T. cameroni* versus *T. rufoclypeus*). *Triepeolus cameroni* also resembles *T. mexicanus* and *T. alvarengai*; see comments under *T. mexicanus* for distinguishing characters. In addition, *T. cameroni* resembles *T. bilineatus*, but can be separated from that species by the pseudopygidial area, which is subrectangular and nearly uniformly golden in *T. cameroni* and circular, with a distinct basal crescent of shining setae in *T. bilineatus*. Males of the two species

can be distinguished by the golden apical fringe of setae strongly surpassing the apical margin of S3 in *T. cameroni*, contrasted with the apical setae only slightly surpassing the apical margin of S3 in *T. bilineatus*. In addition, the paramedian bands do not typically reach the anterior scutal margin and are not anteriorly tapering in *T. cameroni* (but sometimes do in the related species *T. rufoclypeus*).

In The Natural History Museum, London, there are two male specimens labeled by Cameron as *Epeolus bifasciatus* types. Although the original description of this species is headed "*Epeolus bifasciatus* sp. nov. ♀," the remainder of the description is likely that of a male, based on given details of the pygidial plate. I have designated the better preserved male cotype as the lectotype specimen. The label data for the lectotype specimen are as follows: "Type // B. M. Type Hym. 17B.516 // *Epeolus bifasciatus* Cam. Type Mexico // Cameron Coll. 1909-182. // In B. M. 1965 Under *E. cameroni* M-W. // ♂ Sex of type // Lectotype ♂ *Epeolus bifasciatus* Cameron = *E. cameroni* Meade-Waldo des. M. Rightmyer 2005."

Distribution.—BELIZE: Cayo; COSTA RICA Alajuela, Guanacaste, Puntarenas, San José; HONDURAS: El Paraíso; MEXICO: Campeche, Quintana Roo, Tamaulipas, Veracruz, Yucatán.

Floral Records.—*Acacia tenuifolia* (L.) Willd., *Lantana* sp., "white Mimosaceae".

Seasonal Records.—January (day unspecified) to October 14.

Specimens examined.—65 ♀, 21 ♂ (BERKELEY, BOULDER, HEREDIA, LAWRENCE, LOGAN, LONDON, NEW YORK, WASHINGTON D.C.).

TRIEPEOLUS CONCAVUS (CRESSON)

(Frontispiece, Figs. 214–217, 469)

Epeolus concavus Cresson 1878: 85 [Lectotype: Academy of Natural Sciences No. 2241; ♀, California]; Brues 1903: 80 [illustration of female T5 and S5]; Cresson 1916: 115 [designation of lectotype].

Triepeolus concavus; Robertson 1901: 231; Linsley and Michener 1939: plates xv, xviii [illustration of female S6, anterior wing]; Mitchell 1962: 464–465, Figs. 111, 112 [redescription, floral records, illustrations of male genitalia, scutellum, axillae]; Bohart 1970: Fig. 19 [photograph of egg in cell wall of host]; Hurd et al 1980: 28, 90, 91 [habitus illustration, visitation records for *Helianthus* species]; Rozen 1989b: 15, Figs. 24, 25 [description, illustrations of first instar].

Triepeolus concava; Minckley et al. 1994: 1415.

Description.—Length ca. 10–16 mm in length; ITW 2.2–3.1 mm. Integument entirely black or dark brown, except often ferruginous apically on mandibles, basolaterally on labrum, and laterally on F1; dorsal aspect with bands of setae yellow. Clypeus with weak midline and distinct larger punctures (partially obscured in specimens with brown/black setae on clypeus, especially males). Mesepisternum lacking erect, simple setae; with distinct region of yellow, branched setae on dorsal third to fourth, remainder black, covered with minute, contiguous punctures and black or dark brown, branched setae. Paramedian

bands indistinct from dense yellow setae covering anterior third to fourth of scutum. Scutellum strongly to moderately bigibbous; axillar spines triangular, reaching midpoint of scutellum. T1 interspace strongly rectangular to subovate (very reduced in some specimens from Arizona); T2 completely covered with pale yellow setae except for semicircular to subquadrate basal black region. Female: Pseudopygidial area with long, stout setae forming posterior "plate"; S5 strongly downcurved; ventral meso- and metasomata entirely dark brown. Male: Pygidial plate relatively wide, with distinct basal transverse ridge; S4–5 with dark brown apical fringes; rest of metasomal sternal setae dark brown except sometimes with white setae laterally on S3; S3 with apical setae slightly surpassing apical margin.

Comments.—Males of *T. concavus* might be mistaken for *T. remigatus*; however, in *T. remigatus* the paramedian bands and yellow setae on the anterior margin of the scutum form a strong anchor pattern, while in *T. concavus* the paramedian bands are not distinct from the region of dense yellow setae on the anterior third or fourth of the scutum. Males might also be mistaken for *T. nevadensis*; however, in *T. concavus* the metasomal sterna usually lack white setae, while in *T. nevadensis* there is an apical band of white setae on S3. Also, the clypeus of *T. nevadensis* is shining, with distinct larger punctures, while that of *T. concavus* is relatively matte, and covered with setae, thus partly obscuring the larger punctures. The scutum is shinier in *T. nevadensis* (with punctures separated by up to 1 puncture diameter) and the scutellum is somewhat flattened

and extended posteriorly; in *T. concavus* the scutum is matte (with punctures nearly contiguous) and the scutellum is bigibbous, not extended posteriorly.

Distribution.—USA: Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Illinois, Indiana, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, Texas, Utah, Washington, Washington D.C., Wisconsin.

Host Records.—*Svastra* (*Epimelissodes*) *obliqua* (Say) (Custer 1928, observations of adults entering nests, larvae in cells; Bohart 1970, egg in cell; Rozen 1989b, larva from nest).

Floral Records.—*Helenium* sp., *Helianthus annuus* L., *H. tuberosus* L., *Heliopsis helianthoides* (L.) Sweet, *Prionopsis ciliata* [= *Grindelia papposa* Nesom & Suh], *Ratibida pinnata* (Vent.) Barnh., *Verbesina* sp., *Vernonia baldwinii* Torr., "starthistle" (= *Centaurea*).

Seasonal Records.—June 4 to October 21.

Specimens examined.—140 ♀, 33 ♂ (DAVIS, ITHACA, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, PHILADELPHIA, RIVERSIDE, STARKVILLE, TUCSON, URBANA, WASHINGTON D.C.).

TRIEPEOLUS CRESSONII (ROBERTSON)

(Figs. 218, 219, 472)

Epeolus cressonii Robertson 1897: 344 [Lectotype: Illinois Natural History Survey No. 3282a; ♀, Illinois, Macoupin Co., Carlinville; September 15 1886; *Coreopsis* (=*Bidens*) *aristosa*]; Webb 1980: 108 [lectotype designation (by W. E. LaBerge)].

Triepeolus cressonii; Robertson 1901: 231.

Triepeolus cressonii cressonii; Mitchell 1962: 466, Fig. 112 [redescription, floral records, illustrations of scutellum, axillae].

Description.—Length ca. 8–10.5 mm; ITW 1.6–2.3 mm. Integument black, often with at least partially red mandible, labrum, scape, pedicel, F1, tegula, and legs, and occasionally with red pronotal lobe; dorsal aspect with bands of setae pale yellow. Clypeus sometimes elongate, entirely or partly asetose (female) or entirely covered with dense white setae (male), with moderate to strong midline, and weak larger punctures. Female mesepisternum with dorsal region of pale, branched setae often restricted to below scrobal groove (sometimes more extensive), lower pleuron asetose, with dense, small punctures; male mesepisternum usually covered with white, branched setae. Paramedian bands distinct in females; usually laterally contiguous with diffuse pale setae on anterior margin of scutum in males. Scutellum moderately to strongly bigibbous; axillar spines triangular, reaching or slightly exceeding scutellar midpoint, apex sometimes apically incurved and sometimes with reddish tinge at tip. T1 with very wide, parallel-sided (i.e., apical and transverse bands parallel), ovate or quadrate interspace. T2 with lateral longitudinal band of pale setae forming weakly to strongly acute angle with apical transverse band of pale setae. Female: Pseudopygidial area subovate to subquadrate, with distinct basal crescent of shining setae; S5 not or very slightly downcurved apically. Mesosomal and metasomal venter black except for (often diffuse) apical bands of pale setae on

S2–4. Male: Pygidial plate relatively narrow, keyhole shaped, with distinct basal transverse ridge; S4–5 with brown apical fringes of setae (S4 often with white setae on basal margin of fringe); S2–3 usually with uninterrupted bands of white setae.

Comments.—This species very closely resembles *T. helianthi* and *T. laticaudus*; see comments under those species for differentiating features.

Distribution.—USA: Alabama, Georgia, Illinois, Indiana, Kansas, Louisiana, Maryland, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, North Carolina, North Dakota, Oklahoma, Pennsylvania, Tennessee, Texas, South Dakota, Wisconsin.

Floral Records.—*Aster paniculatus* [= *Symphyotrichum lanceolatum* (Willd.) Nesom ssp. *lanceolatum* var. *lanceolatum*], *A. pilosus* [= *Symphyotrichum pilosum* (Willd.) Nesom var. *pilosum*], *Bidens aristosa* (Michx.) Britt., *Brauneria pallida* [= *Echinacea pallida* (Nutt.) Nutt.], *Coreopsis tinctoria* Nutt., *Gaillardia pulchella* Foug., *Helianthus annuus* L., *H. atrorubens* L., *H. petiolaris* Nutt., *H. tuberosus* L., *Monarda* sp., *Nepeta cataria* L., *Physostegia parviflora* Nutt. ex Gray, *Prionopsis ciliata* [= *Grindelia papposa* Nesom & Suh], *Rudbeckia laciniata* L., *Silphium* sp., *Solidago altissima* L., *S. serotina* (= *S. gigantea* Ait.), *Vernonia baldwinii interior* (Small) Faust, *V. missurica* Raf., *V. noveboracensis* (L.) Michx.

Seasonal Records.—June 1 to October 14.

Specimens examined.—154 ♀, 48 ♂ (BERLIN, DAVIS, GAINESVILLE, ITHACA, LAWRENCE, LOS ANGELES, NEW YORK, PHILADELPHIA, STARKVILLE, UNIVERSITY PARK, URBANA, WASHINGTON D.C.).

TRIEPEOLUS CUABITENSIS GENARO

(Figs. 220, 221)

Triepeolus cuabitensis Genaro 1999: 217–218, Figs 1b, 3d [Holotype: Museo Nacional de Historia Natural de Cuba; ♀, Cuabitas, Santiago de Cuba, Cuba; December 1948]. (paratype only viewed)

Description.—Length ca. 7–8.5 mm; ITW 1.4 mm. Integument black to dark reddish brown (especially on mandible, labrum apical clypeus, and venter of metasoma, with orange on antenna, pronotal lobe, tegula, and legs (excluding basal coxae); dorsally with bands of setae yellow. Clypeus with absent to faint midline, lacking larger punctures. Mesepisternum with erect, simple setae, mostly covered by pale yellow, branched setae, but medially with circular region of dark brown, branched setae (this region reduced in male); with punctures nearly contiguous to separated by 0.5 puncture diameter. Paramedian bands tapering anteriorly, reaching anterior margin of scutum, barely laterally contiguous with narrow strip pale setae on anterior margin of scutum. Scutellum moderately bigibbous, with posterior surface (covered by yellow setae) slightly extended posteriorly; axillar spines strongly pointed, incurved, reaching posterior margin of scutellum. T1 interspace widely subovate; T2 with lateral, longitudinal band of

pale setae forming weakly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area entirely brown, vaguely distinct from rest of T5, apically with noticeably coarser, sparser setae; S5 very slightly downcurved apically. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and apical downturned plate; S4–5 with apical fringes of setae brown on S5, pale golden brown on S4; S2–3 with apical bands of white setae (S3 with white setae slightly extending past apical margin).

Distribution.—CUBA: Santiago de Cuba.

Seasonal Records.—December (day unspecified). According to Genaro (1999), a specimen of this species was collected in October.

Specimens examined.—1 ♀, 1 ♂ (GAINESVILLE, LAWRENCE).

TRIEPEOLUS DACOTENSIS (STEVENS)

(Figs. 222, 223, 473)

Epeolus dacotensis Stevens 1919: 210 [Holotype: U. S. National Museum of Natural History No. 23160; ♀, Williston (Williams Co.), North Dakota; August 8 1915; at clay bank].

Triepeolus dacotensis; Bohart 1970: Figs. 20, 22, 24, 27 [photographs of egg membrane, first instar, and mature larvae]; Torchio 1986: 588–596, Figs. 1–8 [biological data, description of embryogenesis and egg eclosion, illustrations of egg, embryo]; Torchio & Burdick 1988: 632 [comparison of egg with that of *E. compactus*]; Rozen 1989b: 15, 16, Figs. 26–28 [description, illustrations of first instar].

Description.—Length ca. 10–12 mm; ITW 2.3–2.7 mm. Integument black; dorsally with bands of setae pale yellow to white. Clypeus with weak

dorsal midline and faint larger punctures. Head and mesosoma with conspicuous erect, simple setae. Mesepisternum with dense, dark brown, erect, simple setae; dorsally with patch of white, branched setae beneath pronotal lobe (pronotal lobe also covered with white, branched setae). Paramedian bands diffuse, joined laterally to diffuse, pale, erect to suberect setae on anterior of scutum. Scutellum weakly bigibbous, axillar spines rounded, not reaching midpoint of scutellum. T1 almost entirely covered by white setae except for black semicircle mediobasally; rest of terga with apical bands uninterrupted; T2 with lateral, longitudinal band of pale setae absent. Venter of mesosoma and metasoma entirely black (both sexes). Female: Pseudopygidial area subrectangular, with apical row of stout setae, basally with fine black setae, poorly differentiated from rest of T5; S5 straight in profile. Male: Pygidial plate very longitudinally rectangular (appearing square when T5 overlaps base), with apical and lateral margins upturned into lamellate rim, apparently lacking transverse basal ridge; S4–5 with dark brown apical fringes; S3 with slight medial extension of dark, apical setae (in one specimen).

Comments.—This is a distinctive species, similar only to *T. mojavensis*, from which it can be separated by the relative amounts and pattern of pale setae on the metasomal terga.

Distribution.—CANADA: Alberta; USA: North Dakota, Utah.

Host Records.—*Anthophora neomexicana* Cockerell? [=*Anthophora* (*Melea*) *bomboides* Kirby] (Stevens, 1919, unspecified observations of nests), *Anthophora* (*Melea*) *occidentalis* Cresson (Stevens, 1919, unspecified

observations of nests; Bohart, 1970, egg and larvae in cells; Torchio, 1986, eggs and immatures from nest; Rozen, 1989b, larvae from nest).

Floral Records.—*Brauneria pallida* [= *Echinacea pallida* (Nutt.) Nutt.], *Helianthus petiolaris* Nutt., *Lactuca tatarica* (L.) C.A. Mey. var. *pulchella* (Pursh) Breitung, *Senecio* sp.

Seasonal Records.—April 15 to July 14.

Specimens examined.—11 ♀, 4 ♂ (AUSTIN, BOULDER, LAWRENCE, NEW YORK, WASHINGTON D.C.).

TRIEPEOLUS DENVERENSIS COCKERELL

(Figs. 224–227)

Triepeolus denverensis Cockerell 1910a: 91 [Holotype: U. S. National Museum of Natural History No. 100022; ♂, Denver, Colorado; August 11 1908 (*Peritoma serrulatum*)].

Description.—Length ca. 8.5–14 mm; ITW 1.8–3.1 mm. Integument black, with red on legs (excluding basal coxae and spurs, sometimes parts of femora, etc.), sometimes on part of mandible, labrum, scape, pedicel, F1, and tegula; dorsally with bands of setae pale yellow (some female specimens from Utah lacking pale banding). Clypeus lacking or with weak midline, lacking larger punctures, sometimes covered with diffuse pale setae (dense in males). Mesepisternum with sparse, erect, simple setae; with patch of pale, dense, branched setae beneath scrobal groove and pronotal lobe; ventrally with punctures small and nearly contiguous, mostly asetose (females) or covered with black,

branched setae (males); female black forms with mesepisternum entirely covered with black setae. Paramedian bands absent (black morphs), distinct, or contiguous with diffuse, pale setae on anterior margin of scutum. Scutellum strongly bigibbous; axillar spines reaching or slightly surpassing midline of scutellum, apical point slightly incurved. T1 interspace transversely rectangular to subovate; T2 with lateral, longitudinal band of pale setae absent or forming 90 degree angel with apical, transverse band of pale setae. Female: Pseudopygidial area longitudinally elongate, strongly triangular, mostly silvery shining, but with small patch of coarse, darker setae subapically (this area of coarse, darker setae shorter than basal region of silvery setae); S5 not or very slightly downcurved, medially longitudinally convex. Male: Pygidial plate with distinct transverse basal ridge and apical downturned plate; S4–5 with dark brown apical fringes of setae; S2–3 with apical bands of white setae (S3 with setae slightly surpassing apical margin).

Comments.—*Triepeolus denverensis* females are readily recognized by the triangular pseudopygidial plate, which is mostly silvery except for the small, subapical patch of dark, coarse setae. This pseudopygidial area is somewhat similar to that of *Triepeolus* sp. 2, and especially *Triepeolus* sp. 42. *Triepeolus denverensis* may be distinguished from *Triepeolus* sp. 2 by the paramedian bands of pale setae on the scutum (forming distinct anchor-shaped pattern in *Triepeolus* sp. 2), the lateral band of pale setae on the T2 (lacking or forming 90 degree angle in *T. denverensis*, forming acute angle in *Triepeolus* sp. 2), and by the

predominantly silver pseudopygidial area in *T. denverensis*, among other characters. *Triepeolus denverensis* may be differentiated from *Triepeolus* sp. 42 by the distinctly coarser texture of the dark, submedian patch of setae on the pseudopygidial area in *T. denverensis*, by the denser punctation of the mesepisternum in *T. denverensis*, and by the distinct larger punctures of the clypeus in *Triepeolus* sp. 42. Some females of this species from Utah are noteworthy for the absence (or partial absence) of bands of pale setae, sometimes resulting in an entirely black appearance.

Distribution.—USA: Arizona (Coconino, Navajo), Colorado, Montana, New Mexico (McKinley), North Dakota, Utah.

Host Records.—*Melissodes* [=*Svastra* (*Epimelissodes*)] *obliqua* (Say)? and *Melissodes* (*Eumelissodes*) *agilis* Cresson? (Cockerell 1910a, collected at same flowers)

Floral Records.—*Chrysothamnus* sp., *Peritoma serrulatum* (=*Cleome serrulata* Pursh), *Senecio longilobus* (=*Senecio flaccidus* Less. var. *flaccidus*).

Seasonal Records.—August 17 to September 23.

Specimens examined.—28 ♀, 1 ♂ (BOULDER, DAVIS, LOGAN, NEW YORK, WASHINGTON D.C.).

TRIEPEOLUS DISTINCTUS (CRESSON)

(Figs. 34, 87, 125, 186, 228–230, 459, 460, 474, 475)

Epeolus distinctus Cresson 1878: 84 [Lectotype: Academy of Natural Sciences No. 2236; ♀, Georgia]; Cresson 1916: 117 [lectotype designation].

Epeolus bardus Cresson 1878: 84–85 [Lectotype: Academy of Natural Sciences No. 2237; ♀, Texas]; Cresson 1916: 113 [lectotype designation]. **new synonymy**

Triepeolus bardus; Cockerell 1903: 331.

Triepeolus mesillae var. a. Cockerell 1903: 331 [♀, Las Cruces (Dona Ana Co.), New Mexico; September 22; *Verbesina encelioides*]. (not seen)

Triepeolus mesillae Cockerell 1904: 36–37 [Holotype: U. S. National Museum of Natural History No. 9704; ♀, Mesilla, (Dona Ana Co., New Mexico); September 24]; Rozen 1966: 16, 17, Figs. 19–23 [description, illustrations of postdefecating larva]. **new synonymy**

Triepeolus pimarum Cockerell 1904: 36–37 [Holotype: U. S. National Museum of Natural History No. 9703; ♀, Alhambra, (Maricopa Co.), Arizona; *Verbesina encelioides*]. **new synonymy**

Triepeolus distinctus; Mitchell 1962: 467, Fig. 112 [redescription, floral records, illustrations of scutellum, axillae]; Wuellner & Hixon 1999: 145–147 [behavior before leaving host nest, chemical components of Dufour's glands, venom glands, and glandular pouches].

Triepeolus distincta; Minckley et al. 1994: 1415.

Description.—Length ca. 10–12.5 mm; ITW 2.1–2.9 mm. Integument black, with red to orange usually entirely or partly on the following: mandibles, labrum, clypeus (especially apically), antennae (especially basally), pronotal lobe, tegula, scutum, scutellum, axillae, mesepisternum, legs, pygidial plate of both sexes; dorsal aspect with bands of setae yellow. Clypeus lacking or with weak midline; covered with golden setae. Head somewhat globular, with preoccipital carina on posterior margin of head as well as on gena. Mesepisternum with

sparse, short, erect, simple setae; irregularly punctate, with punctures relatively large, separated up to 1 puncture diameter in some places, with integument between punctures raised, shining. Paramedian bands distinct, narrow. Scutellum moderately bigibbous; axillar spines well surpassing midpoint of scutellum, incurved, pointed. T1 interspace small, diamond-shaped or rectangular; T2 with lateral longitudinal bands of yellow setae absent or rarely weakly present, forming 90 degree angle with apical transverse band of yellow setae. Female: Pseudopygidial area rectangular, with apical margin straight or weakly concave; setae uniformly dense, coarse, short, and golden-shining; apical margin usually silvery-shining; S5 straight in profile, strongly convex along longitudinal midline, with bristle-like setae present on apical margin; S2–4 lacking white apical bands of setae or with diffuse pale setae on apical margins. Male: Pygidial plate wide, with slightly upturned (lamellate) margins; medioapically often notched; lacking distinct basal transverse ridge. S4–5 with golden brown apical fringes of setae (often white basally on apical fringe of S4); S2–3 with white to pale golden setae on apical margins (often slightly extended sublaterally on S3).

Distribution.—USA: Arizona, Colorado, Georgia, Illinois, Iowa, Kansas, Minnesota, Nebraska, New Mexico, Texas, Utah.

Host Records.—*Dieunomia* (*Dieunomia*) *heteropoda* (Say) (36 specimens from nesting sites, in Cochise Co., Arizona and Bastrop Co., Texas; Wcislo, 1993, adults observed entering nests, prepupae and pupa recovered from nests), *Dieunomia* (*Epinomia*) *triangulifera* (Vachal) (1 specimen entering nest in

Lawrence, Kansas; 3 specimens from nesting site in Lawrence, Kansas; Rozen 1966, larvae presumably taken from nest; Wcislo et al., 1994, adults caught emerging from nests; Wuellner and Hixon, 1999, adults entering nests).

Floral Records.—*Euphorbia dentata* Michx., *Helianthus annuus* L., *H. petiolaris* Nutt., *Heterotheca grandiflora* Nutt., *He. latifolia* [= *He. subaxillaris* (Lam.) Britt. & Rusby], *Monarda punctata* L., *Solidago speciosa* Nutt., *Verbena stricta* Vent., *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray*, V. helianthoides* Michx.

Seasonal Records.—May 10 to October 22.

Specimens examined.—184 ♀, 145 ♂ (AUSTIN, BERKELEY, BOULDER, ITHACA, LAWRENCE, LOS ANGELES, NEW YORK, URBANA, TERRE HAUTE, WASHINGTON D.C.).

TRIEPEOLUS DIVERSIPES COCKERELL

(Figs. 232, 233)

Triepeolus diversipes Cockerell (in Cockerell & Sandhouse, 1924): 314 [Holotype: California Academy of Sciences No. 1608; ♂, San Pedro (Los Angeles Co.), California; October 25 1909].

Description.—Length ca. 10–13 mm; ITW 2.2–3.2 mm. Integument black, with red on part of mandible, orange on F1, and middle and hind legs (excluding basal coxae and spurs), sometimes on tegula and front leg; dorsally with bands of setae pale yellow to yellow. Clypeus with faint midline and larger

punctures, covered with dense white setae in males. Mesepisternum apparently lacking or with extremely sparse, short, erect, simple setae; with punctures small, nearly contiguous; integument between somewhat raised, rough; dorsal third to fourth (except hypoepimeron) covered with dense, pale yellow, branched setae, sometimes with pale setae extending posteroventrally (females), or entire mesepisternum covered with dense, branched, white setae (males). Paramedian bands distinct or contiguous with lateral setae (anterior third to entire scutum sometimes covered with diffuse pale yellow setae). Scutellum strongly to moderately bigibbous; axillar spines triangular, reaching scutellum midpoint, apically somewhat curved inward. T1 interspace widely ovate, rectangular, or triangular; T2 with lateral, longitudinal band of pale setae forming acute to weakly angle with apical, transverse band of pale setae. Female: Pseudopygidial area triangular, mostly covered with very pilose, coarse, golden setae, but basally with fine, dense, golden setae; S5 straight in profile. Male: Pygidial plate keyhole shaped with distinct transverse basal ridge and apical downturned plate; S4–5 with brown to white apical fringes of setae (if brown, then S4 with white setae apicolaterally); S2–3 with apical bands of white setae.

Comments.—The pseudopygidial area of this species somewhat resembles that of *Triepeolus* sp. 60; however the two species can easily be distinguished by the mesepisternum (with much longer erect, simple setae and much more widely-spaced punctures in *Triepeolus* sp. 60), in addition to the much

smaller size of *Triepeolus* sp. 60. A specimen of this species was labeled with a manuscript name indicating a "false pygidium".

Distribution.—USA: California, Colorado, New Mexico, Oregon, Utah.

Floral Records.—*Chrysothamnus* sp., "Helianthoid composite".

Seasonal Records.—August 24 to October 25.

Specimens examined.—16 ♀, 2 ♂ (BOULDER, DAVIS, LOGAN, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS DONATUS (SMITH)

(Figs. 231, 234, 235, 464, 476)

Epeolus donatus Smith 1854: 256 [Holotype: The Natural History Museum, London No. 17B.519; ♀, (Mount Pleasant, Jefferson Co., Ohio)].

Triepeolus donatus; Robertson 1901: 231; Mitchell 1962: 467–468 [redescription].

Triepeolus cirsianus Mitchell 1962: 463–464 [Holotype: Purdue Entomological Research Collections; ♂, Warren Co., Indiana, August 11 1953; thistle]. **new synonymy**

Triepeolus crisianus; Commonwealth Institute of Entomology 1962: 312 [lapsus calami].

Description.—Length ca. 10–13 mm; ITW 2.5–2.7 (rarely as small as 2.0) mm. Integument black (sometimes with purplish tint), with red on distal half of mandible (specimens from Iowa, Minnesota, and North Dakota with red legs); dorsal aspect with bands of setae pale grey/white. Face elongate; clypeus with strong to moderate midline present and weak larger punctures, asetose or covered with white setae. Mesepisternum with relatively sparse, long, erect, simple setae;

punctures small, nearly contiguous to separated by 1–2 puncture widths in some places, especially ventrally; integument between flat or slightly raised (punctures generally denser and integument between sometimes slightly tuberculate in males, especially those from midwestern and north central states). Paramedian bands distinct (females and some males), or connected laterally to diffuse white setae on anterior margin on scutum (most males). Scutellum moderately bigibbous; axillar spines triangular, reaching midpoint of scutellum. T1 interspace widely ovate (sometimes subrectangular), with apical transverse band of pale setae interrupted medially; T2 with lateral bands of pale setae reduced or forming very weakly acute, nearly 90 degree, angle with apical transverse band of pale setae (mostly on lateral surface of T2). Female: Pseudopygidial area subovate to subquadrate, with distinct basal shining crescent; S5 straight in profile; S3–4 with apical bands of pale setae, sometimes restricted laterally (southeastern specimens usually with pale bands only S4, these bands sometimes reduced to a few setae on apicolateral margins). Male: Pygidial plate of moderate size, with strong to weak basal transverse ridge. S4–5 with apical fringes of setae pale brown intermixed with white (S4), or brown medially and white laterally (S5); S2–3 with white apical bands of setae.

Comments.—This species is similar to *T. texanus* in size, the elongate face, and erect, simple setae on mesepisternum; however, in *T. donatus* the bands of setae are white (rather than pale yellow), the T1 interspace is usually more ovate than rectangular, and the pseudopygidial area's basal shining crescent is less

strongly differentiated from the more apical, coarser setae. *Triepeolus donatus* is also similar to *T. georgicus* and *T. atripes*, especially in size and coloration, but unlike the latter two species, *T. donatus* has an elongate face and erect, simple setae on the mesepisternum. *Triepeolus rugosus* is similar in coloration, the elongate face, and erect, simple setae, but is generally smaller and has an irregularly punctate mesepisternum, with the integument between the punctures distinctly raised and somewhat tuberculate.

Distribution.—USA: Connecticut, Delaware, Florida, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, North Dakota, Ohio, Pennsylvania, Vermont, West Virginia, Wisconsin.

Host Records.—*Eutechnia* (sic) (=*Melitoma*) *taurea* (Say)? (Robertson 1901:231, adult entering nest); *Melissodes* (*Heliomelissodes*) *desponsa* Smith (John S. Ascher, in lit. 2004, unpublished data from observations and specimens in New York state). The *Melitoma* host record is for *Triepeolus donatus* entering the nest of *Melitoma taurea*, observed by W. H. Ashmead, who incorrectly concluded that the former species was the builder the nest (Robertson, 1899).

Floral Records.—*Carduus undulatus* [= *Cirsium undulatum* (Nutt.) Spreng. var. *undulatum*], *C. altissimus* [= *Cirsium altissimum* (L.) Hill], *Centaurea jacea* L., *C. vulgare* (Savi) Ten., *Inula helenium* L., *Monarda fistulosa* L., *Rudbeckia laciniata* L., *Silphium perfoliatum* L.

Seasonal Records.—July 26 to October 8.

Specimens examined.—33 ♀, 39 ♂ (ANN ARBOR, BERKELEY, BOULDER, CORVALLIS, DAVIS, ITHACA, LAWRENCE, LOGAN, LONDON, LOS ANGELES, NEW YORK, SAN FRANCISCO, TUCSON, URBANA, WASHINGTON D.C., WEST LAFAYETTE).

TRIEPEOLUS ELDORADENSIS (COCKERELL)

(Figs. 236, 237, 477)

Epeolus eldoradensis Cockerell 1910b: 245–246 [Holotype: U. S. National Museum of Natural History No. 100021; ♂, Eldora (Boulder Co.), Colorado; August 18–19; *Grindelia* (*subalpina*)].

Epeolus eldoradensis var. a Cockerell 1910b: 246.

Description.—Length ca. 7–10 mm; ITW 1.5–2.3 mm. Integument black, usually with red on part of mandible and margins of labrum, orange on F1, tegula, and legs (excluding basal coxae and spurs), sometimes on scape and pedicel; dorsally with bands of setae pale to very pale yellow. Clypeus lacking or with very faint midline and larger punctures (sometimes not visible due to white setae). Mesepisternum with dense, erect, simple setae (sometimes rather short); entirely covered with appressed, pale yellow to white, branched setae (slightly less dense ventrally in females). Paramedian bands poorly distinguished from diffuse pale setae covering scutum. Scutellum weakly bigibbous; axillar spines almost reaching midpoint of scutellum. T1 interspace widely rectangular to ovate, often obscured by sparser pale setae; T2 with lateral, longitudinal band of pale setae

forming 90 degree angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular to subquadrate, with distinct, relatively long, basal region of silvery setae and larger apical region of coarse, darker setae; S5 very slightly downcurved. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and apical downturned plate; S4–5 with apical fringes of setae golden brown on S5, white on S4; S2–3 with apical bands of setae white (S3 with white setae slightly surpassing apical margin).

Comments.—This species is similar to *T. argyreus* and *T. paenepectoralis*; see Table 4 for certain differentiating characters of those species. *Triepeolus eldoradensis* also resembles *Triepeolus* sp. 59, but *T. eldoradensis* has erect, simple setae on the mesepisternum, the lateral longitudinal band of pale setae on the T2 forms a 90 degree angle with the apical transverse band of pale setae, and the pseudopygidial area has a distinct basal shining crescent.

Distribution.—USA: Colorado, Idaho, Utah, Wyoming.

Floral Records.—*Aster* sp. (= *Symphyotrichum*), *Grindelia squarrosa* (Pursh) Dunal, *G. subalpina* Greene.

Seasonal Records.—July 20 to October 17.

Specimens examined.—28 ♀, 1 ♂ (LAWRENCE, LOGAN, URBANA, WASHINGTON D.C.).

TRIEPEOLUS EPEOLURUS RIGHTMYER

(Figs. 36, 93, 123, 128, 151, 164, 189, 238, 239)

Triepeolus epeolurus Rightmyer 2004a: 25–28 [Holotype: University of Kansas Natural History Museum and Biodiversity Research Center No. 9162; ♀, Los Sabinos, Michoacán, Mexico; 1190 m; October 29 1987].

Description.—Length ca. 8.5–10.5 mm; ITW 1.6–2.1 mm. Integument black to brown, with red on apical mandible, and sometimes on scape, pedicel, and F1; dorsally with bands of setae yellow to pale yellow (males with bands of setae on metasomal terga grading from yellow to white posteriorly). Labrum with apical tubercles often produced into scoop-like structure. Clypeus lacking or with weak dorsal midline; lacking larger punctures, sometimes covered with diffuse, white setae (usually denser in males). Mesepisternum with regions of dense, white, branched setae beneath scrobal groove and below pronotal lobe (sometimes diffuse on hypoepimeron); lacking erect, simple setae; lower mesepisternum with punctures nearly contiguous, sometimes covered with diffuse, brown, branched setae (usually denser and paler in males). Paramedian bands distinct, relatively short. Scutellum weakly to moderately bigibbous, axillar spines triangular, reaching or not reaching midpoint of scutellum. T1 interspace triangular to ovate; T2 lacking lateral, longitudinal band of pale setae. Metasomal terga with apical bands interrupted medially (at least T1–3). Female: Pseudopygidial area with distinct transverse, basal, region of silvery setae, apically with dark, long, stout setae; S5 straight in profile. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and downturned apical plate; S4–5 with relatively weak

apical fringes of setae (brown on S5, brown and white on S4); S2–3 with white apical bands setae (S2 with white setae extending slightly past apical margin).

Comments.—Females of this species are easily recognized by the unique pseudopygidial area.

Distribution.—COSTA RICA: Alajuela, Guanacaste; MEXICO: Jalisco, Michoacán, Oaxaca.

Seasonal Records.—September 22 to December 5.

Specimens examined.—24 ♀, 9 ♂ (BERKELEY, CHAMELA, GAINESVILLE, LAWRENCE, LOGAN).

TRIEPEOLUS FRASERAE COCKERELL

(Figs. 240, 241)

Triepeolus cressoni var. *fraserae* Cockerell 1904: 39 [Holotype: U. S. National Museum of Natural History No. 9708; ♂, Beulah (San Miguel Co.), New Mexico; June 29; *Frasera*].

Triepeolus loganensis Cockerell 1925a: 624 [Holotype: U. S. National Museum of Natural History No. 100032; ♂, Logan Co., Colorado; August 23 1923]. **new synonymy**

Triepeolus sandhousae Cockerell 1925a: 624–625 [Holotype: U. S. National Museum of Natural History No. 100036; ♂, Logan Co., Colorado; August 23 1923]. **new synonymy**

Triepeolus fraseri; Hurd 1979: 2093 [lapsus calami].

Description.—Length ca. 7–12 mm; ITW 1.2–2.2 mm. Integument black, with red on part of mandible, orange on F1 and legs (excluding basal coxae and spurs; often with brown patches on at least foreleg), sometimes on part or entire labrum, scape, pedicel, and tegula; dorsally with bands of setae pale yellow.

Clypeus with distinct (sometimes weak) midline and weak larger punctures, integument shining or less frequently covered with diffuse pale yellow setae (often entirely covered by dense white setae in males). Mesepisternum with sparse, erect, simple setae; dorsal half with dense, pale yellow, branched, appressed setae, medioventrally and hypoepimeron with pale yellow, branched setae more diffuse or with diffuse brown, branched setae; punctures small, nearly contiguous to separated by up to 2 puncture diameters in some places, integument between punctures shining, somewhat elevated (females), or entire mesepisternum covered with dense, pale yellow, branched setae (sparser on hypoepimeron; males). Paramedian bands distinct from or laterally contiguous with pale setae near anterior margin of scutum. Scutellum moderately bigibbous, sometimes with longitudinal line of pale yellow setae between biconvexities; axillar spines triangular, reaching midpoint of scutellum, often slightly incurved apically. T1 interspace widely ovate; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular, with distinct basal crescent of silvery setae; S5 weakly to moderately downcurved. Male: Pygidial plate keyhole shaped, with distinct basal transverse ridge and apical downturned plate; S4–5 with brown or brown and white apical fringes of setae; S2–3 with strong, rather broad white apical bands strongly contrasting with dense brown setae basally (S3 with white setae slightly surpassing apical margin).

Comments.—This species is similar to *Triepeolus* spp. 59, 97, and 119, but can be separated from those species by the erect, simple setae on the mesepisternum of *T. fraserae*. It is also similar to *T. micropygius*; see comments under that species for differentiating characters.

Distribution.—USA: Arizona, California, Colorado, Montana, New Mexico, North Dakota, Utah, Wyoming.

Floral Records.—*Frasera* sp., *Grindelia squarrosa* (Pursh) Dunal, *Gutierrezia* sp., *Helianthus annuus* L., *Isocoma tenuisecta* Greene.

Seasonal Records.—June 21 to November 2.

Specimens examined.—55 ♀, 6 ♂ (BOULDER, DAVIS, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, RIVERSIDE, TEMPE, WASHINGTON D.C.).

TRIEPEOLUS GEORGICUS MITCHELL

(Figs. 242, 243)

Triepeolus georgicus Mitchell 1962: 469–470, Fig.112 [Holotype: U. S. National Museum of Natural History No. 400192; ♀, Fort Gordon, Richmond Co., Georgia; September 24 1958].

Triepeolus floridanus Mitchell 1962: 468–469 [Holotype: Florida State Collection of Arthropods; ♂, Gainesville (Alachua Co.), Florida; October 28 1956]. **new synonymy**

Description.—Length ca. 11 mm; ITW 2.2–2.3 mm. Integument black, with red on mandible and sometimes on F1; dorsal aspect with bands of setae pale grey to white. Tegula more or less transparent on apical margin. Clypeus with

weak midline, lacking or with weak larger punctures, nearly or entirely asetose. Mesepisternum lacking erect, simple setae; punctures spaced up to 2 puncture diameters apart, integument between flat; with dense, white, branched setae mostly restricted to dorsal half or fourth. Paramedian bands connected laterally to diffuse white setae on anterior margin of scutum, or barely distinct in some females. Scutellum moderately to strongly bigibbous, axillar spines reaching or slightly surpassing scutellar midpoint, weakly incurved apically. T1 interspace widely ovate; T2 with lateral longitudinal band of pale setae forming weakly acute angle with apical transverse band of pale setae (mostly on lateral margin of T2). Female: Pseudopygidial area ovate, with distinct basal shining setae; S5 weakly downcurved apically; S2–4 with white setae on apical, or only apicolateral, margins (sometimes faint on S2). Male: Pygidial plate moderately wide, weakly keyhole shaped, with distinct basal transverse ridge. S4–5 with brown apical fringes; S2–3 with white setae apically (sometimes with small patch white setae on apicolateral margin of S4).

Comments.—This species is very similar to *T. donatus*, but *T. georgicus* lacks erect, simple setae on mesepisternum and the clypeus is not elongate. *Triepeolus georgicus* is also similar to *T. atripes*, except in *T. georgicus* the clypeus is more convex in profile, with a modest midline (as opposed to a relatively flattened clypeus with a strong midline), the lower mesepisternum is relatively flat, with punctures separated by up to a puncture diameter (as opposed to almost contiguous, with the integument between the punctures raised, slightly

tuberculate in appearance), and in the females, the paramedian bands reach the anterior margin of the scutum, the pseudopygidial area has a basal crescent that is shorter than that of *T. atripes*, and the S5 is slightly less downcurved. *Triepeolus georgicus* is less likely to be confused with *T. cressonii*, but can be distinguished from that species by the pale grey to white band coloration and black integument except for the mandibles and F1 (as opposed to pale yellow band coloration, usually with at least some areas of red integument on the legs and face in *T. cressonii*).

The number of submarginal cells in this species appears to be labile, much like that of *T. obliteratus*: there is a tiny "fourth" submarginal cell in one wing of the holotype of *T. floridanus*.

Distribution.—USA: Florida, Georgia, Mississippi.

Seasonal Records.—September 24 to October 28.

Specimens examined.—6 ♀, 3 ♂ (GAINESVILLE, STARKVILLE, WASHINGTON D.C.).

TRIEPEOLUS GRANDIS (FRIESE)

(Figs. 244, 245, 470, 471, 478)

Epeolus grandis Friese 1917 [1916]: 338 [Holotype: Zoologisches Museum, Humboldt-Universität; ♂, Jacubaya (=Tacubaya?, see comments below), Mexico].

Triepeolus species A; Rozen 1966: 12–14, Figs. 8–14 [description, illustrations of postdefecating larva].

Triepeolus species b; Rozen 1984: 7, 11, 18 Figs. 6, 23 [potential defense by host, biology, illustrations of postdefecating larva and first instar on host provisions].

Triepeolus grandi; Ayala 1988: 404.

Triepeolus grandis; Rozen 1989a: 2–10, Figs. 1–6, 10–17 [redescription, biology, illustrations of adult, pupa, egg]; Rozen 1989b: 1–14, Figs. 1–18 [descriptions, illustrations of first and second instars].

Description.—Length ca. 11–15 mm; ITW 2.9–3.6 mm. Integument black, with dark reddish brown to orange on basal mandible and F1, usually on labrum, scape, and pedicel, sometimes on apical margin of clypeus, rarely on pronotal lobe, almost always orange on tegula, usually on legs (excluding basal coxae and spurs, sometimes with black areas on tibiae, profemur, and trochanters; or legs rarely entirely black); dorsally with bands of setae pale yellow to yellow. Clypeus with weak or strong midline and larger punctures, entirely covered with white setae in males. Mesepisternum with erect, simple setae; dorsal half with dense, pale yellow, branched setae (absent or sparser on hypoepimeron), sometimes extending along anterior and posterior margins; ventrally with sparser, black, branched setae; punctures small, nearly contiguous to separated by a puncture diameter, with integument between punctures raised, tuberculate (females); or mesepisternum covered with dense, white, branched setae, except for small medioventral patch of dense, brown, branched setae (males). Paramedian bands distinct, robust (rarely barely contiguous with lateral setae). Scutellum strongly to moderately bigibbous; axillar spines triangular, reaching or

well surpassing midpoint of scutellum, apical spine somewhat incurved in those specimens with longer spine. T1 interspace quadrate, sometimes subtriangular or triangular; T2 with lateral, longitudinal band of pale setae forming acute to weakly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area ovate, with uniformly fine, darkly shining setae; S5 straight in profile. Male: Pygidial plate relatively wide, with distinct transverse basal ridge and apical downturned plate; S3–5 with apical fringes of setae, golden on S4–5, white and shorter on S3; S2 with apical band of white setae.

Comments.—Tacubaya is a possible correct spelling of the type locality, as "Jacubaya" cannot be found in any atlas available to me. There is a locality called Tacubaya in each of the following Mexican states: Chihuahua, Guanajuato, Oaxaca, and Yucatán, as well as in the Distrito Federal. Alternatively, Ayala (1999: 24) states that Jacubaya is a possible locality in Veracruz.

The original description of *Epeolus grandis* is based on one male specimen; thus it is the holotype specimen by default.

Triepeolus grandis is found in abundance in the southwestern United States. Rozen (1989a) redescribed and provided biological data for this species. I did not see any specimens resembling the "pale" forms illustrated by him (e.g., Fig. 1 in Rozen 1989a); it is possible that we had different concepts of the species. *Triepeolus grandis* is very similar to *T. zacatecus*; presumably the latter species is the black-legged form of *T. grandis* from the west coast of Mexico referred to by

Rozen (1989a: 8). In fact, *T. grandis* is only separable from *T. zacatecus* (usually) by the orange legs, paler yellow bands of setae, narrower bands of yellow setae on T1 and T2, and shorter axillar spines. *Triepeolus grandis* is superficially similar to *T. remigatus*, but *T. grandis* has erect, simple setae on the mesepisternum, the paramedian bands are distinct, and the T1 interspace is quadrate to subtriangular. A specimen of this species was identified as "PCAM 2" by D. Yanega; another specimen was given a manuscript name by Paul Hurd honoring Mont A. Cazier.

This species is parasitic on the predominately crepuscular or nocturnal subfamily Diphaglossinae; one of its known host species, *Ptiloglossa arizonensis*, was recorded flying as early as 5 am in Portal Arizona (Rozen, 1984).

Distribution.—MEXICO: Baja California, Chihuahua, Distrito Federal, Durango, Jalisco, Querétaro, Sonora, Zacatecas; USA: Arizona, Kansas, New Mexico, Oklahoma, Texas.

Host Records.—*Caupolicana* (*Caupolicana*) *yarrowi* (Cresson) (Jim Cane, in. litt., 2005, visiting nest); *Ptiloglossa arizonensis* Timberlake (Rozen, 1984, eggs and larvae from cells; Rozen, 1989b larvae from cells), *Ptiloglossa jonesi* Timberlake (Rozen, 1966, larvae from cells; Rozen, 1984, larvae taken from cells; Rozen, 1989b, larva from cell).

Floral Records.—*Aloysia gratissima* (Gillies & Hook.) Troncoso, *A. wrightii* (Gray) A. Heller ex Abrams, *Asclepias subverticillata* (A. Gray) Vail, *Baccharis* sp., *Bahia absinthifolia* var. *dealbata* (Gray) Gray, *Baileya*

multiradiata Harv., *Chilopsis linearis* (Cav.) Sweet, *Eriogonum deflexum* Torr., *Gaillardia pulchella* Foug., *Gutierrezia* sp., *Helianthus petiolaris* Nutt., *Heliotropium* sp., *Heterotheca subaxillaris* (Lam.) Britt. & Rusby, *Hoffmanseggia jamesii* [= *Pomaria jamesii* (Torr. & Gray) Walp.], *Kallstroemia grandiflora* Torr. ex Gray, *Larrea tridentata* (Sessé & Moc. ex DC.) Coville, *Marrubium vulgare* L., *Melilotus officinalis* (L.) Lam., *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray.

Seasonal Records.—March 3 to October 14.

Specimens examined.—195 ♀, 1 ♂ (AUSTIN, BOULDER, CHAMELA, CORVALLIS, DAVIS, GAINESVILLE, ITHACA, LAWRENCE, LOGAN, LOS ANGELES, MEXICO CITY, NEW YORK, RIVERSIDE, SAN FRANCISCO, TEMPE, WASHINGTON D.C.).

TRIEPEOLUS HELIANTHI (ROBERTSON)

(Figs. 246, 247)

Epeolus helianthi Robertson 1897: 344 [Lectotype: Illinois Natural History Survey No. 9496; ♀, Carlinville, Macoupin Co., Illinois; September 18 1890; *Helianthus grosseserratus*]; Webb 1980: 108 [lectotype designation (by W. E. LaBerge)]

Triepeolus helianthi; Robertson 1901: 231; Graenicher 1905: 164–166, Fig. 7 [description, illustrations of larva]; Parker et al. 1981: 48, 51, Figs. 9–14 [description, photographs of prepupae and egg chorion, behavior of adults].

Triepeolus helianthi var. *arizonensis* Cockerell 1904: 39 [Holotype: U. S. National Museum of Natural History No. 9707; ♂, Phoenix, Arizona; October 9; *Helianthus annuus*]. **new synonymy**

Triepeolus coquilletti Cockerell 1905c: 106 [Holotype: U. S. National Museum of Natural History No. 9908; ♀, San Bernardino Co., California; October]. **new synonymy**

Triepeolus helianthi helianthi; Cockerell 1919b: 300

Triepeolus helianthi pacificus Cockerell 1919b: 300 [Holotype: U. S. National Museum of Natural History No. 100031; ♂, Peaceful Valley (Boulder Co.), Colorado; August 26]. **new synonymy**

Triepeolus maculiventris Cockerell 1921: 11–12 [Holotype: American Museum of Natural History No. 25095; ♀, (Navajo Canyon), Mesa Verde (National Park), Colorado; about 37˚11'N, 108˚30'W; 6600 ft.; July (5) 1919 (*Helianthus petiolaris*)]. **new synonymy**

Triepeolus lineatulus Cockerell & Sandhouse 1924: 306–307 [Holotype: California Academy of Sciences No. 1598; ♀, Stockton (San Joaquin Co.), California; August 20 1919]. **new synonymy**

Description.—Length ca. 8.5–12 mm; ITW 1.7–2.7 mm. Integument black, with the following sometimes at least partly reddish: mandibles, labrum, clypeus, scape, pedicel, F1, pronotal lobe, tegula, legs; dorsal aspect with bands of setae yellow to pale yellow. Clypeus slightly elongate, asetose (in females) with strong to moderate midline (male clypeus basally covered with white setae). Mesepisternum lacking erect, simple setae (sometimes appearing to have very short, sparse, erect, simple setae in males), females with distinct, "L" shaped dorsal region of pale, branched setae (pale setae absent on hypoepimeron), lower pleuron black, asetose with very dense, small punctures (separated by up to 1 puncture diameter in some places); male mesepisternum more generally covered with white, branched setae, often with brown patch medioventrally. Paramedian

bands distinct, rarely laterally contiguous with diffuse pale setae on anterior margin of scutum in some males. Scutellum moderately to strongly bigibbous; axillar spines triangular, reaching or exceeding scutellar midpoint, often apically pointed and slightly incurved. T1 with very wide, parallel-sided (i.e., apical and transverse bands parallel), laterally rounded, ovate interspace. T2 with lateral longitudinal band of pale setae forming weakly acute angle with apical transverse band of pale setae. Female: Pseudopygidial area subovate, with very vague, almost indistinguishable basal crescent (formed by increase in density, but not texture, of setae), appearing brownish (rather than silvery) throughout; S5 very slightly downcurved. Mesosomal and metasomal venter black except for slight lateral patches of white setae on S3–4 (sometimes also on S2). Male: Pygidial plate strongly keyhole shaped, with distinct basal transverse ridge; S4–5 with brown apical fringes of setae; S2–3 with white apical bands, often restricted laterally, sometimes with white setae apicolaterally on S4.

Comments.—This species is very similar to *T. cressonii*. Females can be separated by the pseudopygidial area, which is a more elongate oval, with a distinct basal crescent of shining setae in *T. cressonii*, while in *T. helianthi* the pseudopygidial area is more circular, and the setae of the entire area are nearly uniform in reflectance; the mesepisternum in *T. cressonii* has dense pale setae more or less restricted to beneath the scrobal groove (sometimes these pale setae are more extensive), while in *T. helianthi* there are more such pale setae dorsally on the mesepisternum, forming an "L"-shaped pattern; and in *T. cressonii* there

are pale setae laterally on S2–4, while in *T. helianthi* the pale setae are sometimes only on S3–4. The males are extremely similar, but may be separated based on the following characters: the clypeus tends to be entirely covered with white setae in *T. cressonii*, while in *T. helianthi* the clypeus is usually apically asetose; T1–4 usually have pale bands that are medially interrupted in *T. cressonii*, while in *T. helianthi* the pale bands are often (but not always) interrupted on T1 and T2; the paramedian bands are usually laterally contiguous with pale setae on the anterior margin of the scutum in *T. cressonii*, while in *T. helianthi* the paramedian bands are usually distinct; and S2–3 usually have white apical bands entire in *T. cressonii*, while in *T. helianthi* the white apical bands often medially interrupted.

Distribution.—CANADA: Alberta; MEXICO: Chihuahua, Coahuila, Nuevo León; USA: Arizona, California, Colorado, Connecticut, Illinois, Indiana, Kansas, Maryland, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Oregon, South Dakota, Texas, Utah, Virginia, Washington, Wisconsin, Wyoming.

Host Records.—*Dieunomia* (*Dieunomia*) *heteropoda* (Say)? (1 specimen from nest site), *Nomia* (*Acunomia*) *melanderi* Cockerell? (1 specimen from nest site in Utah); *Melissodes* (*Eumelissodes*) *agilis* Cresson (Parker et al. 1981, adult entering nest, prepupae from cells), *Melissodes* (*Callimelissodes*) *composita* Tucker? (Hurd and Linsley 1959, adults entering nests), *Melissodes* (*Eumelissodes*) *trinodis* Robertson (Graenicher 1905, observations of host and parasite larvae).

Floral Records.—*Aster* sp. (= *Symphyotrichum*), *Chrysanthemum* sp., *Chrysopsis mariana* (L.) Ell., *Chrysothamnus* sp., *Gaillardia* sp., *Grindelia squarrosa* (Pursh) Dunal, *Helianthus annuus* L., *H. grosseserratus* Martens, *H. petiolaris* Nutt., *H. tuberosus* L., *Heterotheca latifolia* [= *He. subaxillaris* (Lam.) Britt. & Rusby], *Phacelia* sp., *Polygonum* sp. *Salvia* sp., *Verbena stricta* Vent., *Verbesina* sp., *Vernonia baldwinii* Torr., *V. missurica* Raf., *Viguiera* sp.

Seasonal Records.—June 20 to October 26.

Specimens examined.—321 ♀, 37 ♂ (AUSTIN, BERLIN, BERKELEY, BOULDER, CHAMELA, CORVALLIS, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, NEW YORK-ASCHER, RIVERSIDE, SAN DIEGO, SAN FRANCISCO, STARKVILLE, URBANA, WASHINGTON D.C.).

TRIEPEOLUS HETERURUS (COCKERELL)

(Figs. 95, 122, 187, 248–251)

Epeolus heterurus Cockerell & Sandhouse 1924: 316–317 [Holotype: California Academy of Sciences No. 1611; ♀, Redding (Shasta Co.), California; July 6 1918.

Epeolus piscatoris Cockerell 1939: 432–433 [Holotype: California Academy of Sciences No. 6652; ♀, Fisherman's Cove, Santa Catalina Island, California; June 9 1933; *Sinapis*]; Rust 1984: 120 [synonymy].

Epeolus utahensis Cockerell 1921: 15–16 [Holotype: American Museum of Natural History No. 25112; ♂, Huntsville (near Ogden, Weber Co.), Utah; July 26 1920; about 41˚ 17'N, 110˚ 46'W]. **new synonymy**

Triepeolus piscatoris (Cockerell); Brumley 1965: 73.

Description.—Length ca. 7–9 mm; ITW 1.3–1.9 mm. Integument black, with red on part of mandible; dorsally with bands of setae pale yellow. Clypeus lacking midline and larger punctures, sometimes covered with diffuse, pale setae. Mesepisternum with dorsal half covered with white, suberect to erect branched setae, anterior margin with sparse, erect, simple setae, ventral half with punctures nearly contiguous, often covered with diffuse, brown, branched setae (females), or covered with erect to suberect, dense, white, branched setae (males). Paramedian bands distinct (some females), or contiguous with pale setae on anterior margin of scutum (males and most females). Scutellum weakly bigibbous, axillar spines triangular, reaching or not reaching midpoint of scutellum. T1 interspace subovate to subquadrate; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area with long setae, parted medially and directed laterally, apical margin concave; S5 slightly downcurved at apical margin. Male: Pygidial plate very narrow and long, apparently lacking transverse basal ridge; S4–5 with brown apical fringes; S2–3 with apical bands white setae (S3 with white setae slightly extended past apical margin).

Comments.—This species is very similar to *T. melanarius*. Females can easily be distinguished by the pseudopygidial area, which is parted medially and apically concave in *T. heterurus*. Males of the two species are extremely similar, but can be differentiated by the apical bands of white setae on S2–3 in males of *T. heterurus* (metasomal sterna entirely brown in *T. melanarius*). In addition, in

males, the lower mesepisternum is darker in *T. melanarius* than in *T. heterurus*, and the paramedian bands are distinct in *T. melanarius*, while in *T. heterurus* they are usually surrounded by diffuse pale setae on the anterior margin of the scutum.

A variety of this species exists [represented by two females, from Baja California (repository: San Francisco) and Glendora California (repository: Urbana)], in which the pseudopygidial area has setae that are much shorter than that of the typical *T. heterurus*. In addition, in these females, the integument is brownish red instead of black, and the mesepisternum has a distinct, medioventral spot of brown setae. They may represent another species.

Distribution.—MEXICO: Baja California; USA: California, Idaho, Nevada, Oregon, Utah, Wyoming.

Floral Records.—*Chrysothamnus* sp., *Eriogonum* sp. *Grindelia camporum* Greene, *Hemizonia pugens* (Hook. and Arn.) Torrey and Gray, *Mentha spicata* L., *Sinapis* sp., *Solidago californica* Nutt., *Wislizenia refracta* Engelm.

Seasonal Records.—May 10 to October 16

Specimens examined.—69 ♀, 89 ♂ (BERKELEY, BOULDER, CORVALLIS, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, NEW YORK-ASCHER, SAN FRANCISCO, URBANA, WASHINGTON D.C.).

TRIEPEOLUS INTREPIDUS (SMITH)

(Figs. 252, 253)

Epeolus intrepidus Smith 1879: 102 [Holotype: The Natural History Museum, London No. 17B.521; ♂, Mexico].

Triepeolus digueti Cockerell 1905b: 165 [Holotype: U. S. National Museum of Natural History No. 23290; ♀, Oaxaca, Mexico]. **new synonymy**

Epeolus nobilis Friese 1908: 85 [Lectotype: Zoologisches Museum, Humboldt-Universität; ♂, Argentini (= Argentina, Chiapas?), M. (= Mexico?); 1900]. **new synonymy, new lectotype designation**

Triepeolus intrepidus (Smith); Cockerell 1949: 460.

Description.—Length ca. 12–17 mm; ITW 2.7–3.2 mm. Integument black, with red to orange on basal mandible, labrum, apical or entire clypeus, scape, pedicel, F1, basal F2, tegula, and legs (excluding coxae and sometimes trochanters and spurs), usually on part or entire scutellum (contrasting with black axillar spine), sometimes partially on scutum; dorsally with bands of setae bright yellow. Clypeus lacking or with weak midline and larger punctures, often covered with diffuse golden setae. Mesepisternum with erect, golden, simple and minutely branched setae (usually denser in males); ventral half with punctures nearly contiguous to separated by 2 puncture diameters. Paramedian bands absent; scutum densely covered with erect, golden setae. Scutellum moderately bigibbous; axillar spines rounded apically, not reaching midpoint of scutellum. T1 interspace triangular; T2 with lateral, longitudinal band of pale setae absent or forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area golden, poorly differentiated from rest of T5, indicated by flattened, ovate plane; S5 very slightly downcurved. Male: Pygidial plate

longitudinally elongate, slightly keyhole shaped, lacking distinct apical downturned plate; S3–5 with well-developed, golden, apical fringes of setae.

Comments.—*Triepeolus intrepidus* is more commonly known by its junior synonym, *T. digueti*. It is readily recognized by the bright red scutellum, contrasting with the short, black axillar spines; by the erect, golden setae covering much of the head and mesosoma; and by the pattern of the bands of yellow setae on the metasoma.

The name "*Triepeolus nobilis*," a synonymous name with *T. intrepidu*s, has long been confused with the species *T. osiriformis*, possibly due to the fact that both *T. intrepidus* and *T. osiriformis* usually have a bright red scutellum, and because of the confusing collection locality of the *T. nobilis* lectotype (i.e., "M. Argentini"), which is suggestive of the country Argentina, rather than what is presumably a locality in Mexico. In his original description of *T. osiriformis*, Schrottky (1910) notes the fact that the species is quite distinct from *T. nobilis*, despite running to that species in the key provided by Friese (1908). In fact, *T. intrepidus* appears to be restricted to Central and North America, while *T. osiriformis* is widely distributed in South America, including Argentina.

Friese's original description of *Epeolus nobilis* was based on both males and females. In the Berlin Museum, both a male and female of this species identified by Friese are present, but only the male specimen bears a type label; thus I recognize the male as the lectotype specimen. The lectotype label data are

as follows: "M // Argentini 1900 // *Epeolus nobilis* Fr. ♂ 1907 Friese det. // Type [red label] // Lectotype ♂ *Epeolus nobili*s Friese des. M. Rightmyer 2006"

Distribution.—MEXICO: Chiapas, Chihuahua, Hidalgo, Jalisco, Michoacán, Morelos, Nuevo León, Oaxaca, Zacatecas; USA: Arizona, New Mexico, Texas.

Host Records.—*Melissodes* (= *Syntrichalonia*) *exquisita* (Cresson) (Cockerell, 1905b, flying near nest entrance).

Floral Records.—*Asclepias subverticillata* (A. Gray) Vail, *Encelia farinosa* Gray ex Torr., *Helianthus* sp., *Senecio longilobus* (=*Senecio flaccidus* Less. var. *flaccidus*), *S. salignus* [=*Barkleyanthus salicifolius* (Kunth) H.E. Robins. & Brett.], *Simsia exaristata* (= *Simsia lagasceiformis* DC.), *Tagetes erecta* L., *Viguiera dentata* (Cav.) Spreng.

Seasonal Records.—July 26 to November 13.

Specimens examined.—11 ♀, 24 ♂ (AUSTIN, BERKELEY, CHAMELA, DAVIS, LAWRENCE, LOS ANGELES, NEW YORK, TUCSON, WASHINGTON D.C.).

TRIEPEOLUS LATICAUDUS COCKERELL

(Figs. 254, 255)

Triepeolus laticaudus Cockerell 1921: 12–13 [Holotype: American Museum of Natural History No. 25096; ♀, Ute Pass, Cascade (El Paso Co.), Colorado; August 22 1914].

Description.—Length ca. 7.5–12 mm; ITW 1.6–2.7 mm. Integument black, with dark reddish brown to orange on part of mandible, F1, and tegula,

orange on part or entire legs (excluding basal coxae and spurs), often on labrum, apical clypeus, scape, and pedicel; dorsally with bands of setae pale yellow. Clypeus with faint to strong midline and larger punctures. Mesepisternum lacking erect, simple setae; dorsal half covered with dense, pale yellow, branched setae (absent or sparser on hypoepimeron), ventrally sometimes with pale, branched setae also on margins, enclosing vague black region medially (sometimes with sparse pale setae medially as well); punctures nearly contiguous to separated by a puncture diameter, with integument between shining. Paramedian bands distinct. Scutellum moderately bigibbous; axillar spines triangular, reaching midpoint of scutellum. T1 widely subquadrate; T2 with lateral longitudinal band of pale setae forming weakly acute angle with apical transverse band of pale setae, mostly on lateral surface of T2. Female: Pseudopygidial area subtriangular to subquadrate, with distinct, relatively long, basal shining region, and extending laterally to apical margin of area, with median circular region of stout setae; S5 straight in profile to slightly downcurved; S3–4 (and sometimes S2) with patches of white setae laterally. Male: Unknown.

Comments.—This species is superficially similar to *T. cressonii*, but can be differentiated from that species by the mesepisternum (in *T. laticaudus* the dorsal third is mostly covered by dense, pale setae, and medioventrally the integument between the punctures is distinctly raised, appearing tuberculate, while in *T. cressonii* the pale setae is more restricted dorsally, and the integument is much flatter between punctures medioventrally). Also, the basal shining setae

of the pseudopygidial area is longer in *T. laticaudus* than in *T. cressonii*. *Triepeolus laticaudus* is also similar to *Triepeolus* sp. 95, but can be differentiated from that species by the mesepisternum, which has sparser punctures and the integument between the punctures appears more tuberculate. Finally, this species is similar to *T. townsendi*; see comments under that species for differentiating characters.

Distribution.—MEXICO: Coahuila, Durango; USA: Arizona, Colorado, Kansas, New Mexico, South Dakota, Texas.

Floral Records.—*Amphiachyris dracunculoides* (DC.) Nutt., *Aster* sp. (= *Symphyotrichum*), *Bidens pilosa L.*, *Calyptocarpus vialis* Less., *Gaillardia* sp., *Grindelia squarrosa* (Pursh) Dunal, *Gutierrezia sarothrae* (Pursh) Britt. & Rusby, *Haplopappus gracilis* [= *Machaeranthera gracilis* (Nutt.) Shinners], *Heterotheca subaxillaris* (Lam.) Britt. & Rusby, *H. villosa* (Pursh) Shinners, *Melilotus officinalis* (L.) Lam., *Solidago serotina* (= *S. gigantea* Ait.), *Verbesina* sp.

Seasonal Records.—June 11 to November 6.

Specimens examined.—87 ♀ (AUSTIN, BOULDER, CHAMELA, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, TEMPE, WASHINGTON D.C.).

TRIEPEOLUS LATICEPS (FRIESE)

(Figs. 256, 257)

Epeolus laticeps Friese 1917 [1916]: 338 [Holotype: Zoologisches Museum, Humboldt-Universität; ♂, Jacubaya (=Tacubaya?, see comments under *T. grandis*), Mexico; 1900].

Description.—Length ca. 9–14 mm; ITW 2.0–3.1 mm ITW (the larger size more common); integument black, with red on part of mandible, orange on F1, less commonly on tegula and part or most of legs (especially on middle and hind legs, not on coxae or spurs); dorsally with bands of setae yellow-orange to pale yellow. Clypeus with strong midline, usually covered with white setae, with tuberculate-like setal bases apparent beneath (denser in male). Upper face with rough punctation, integument shining. Mesepisternum lacking erect, simple setae or with very sparse, short, erect, simple setae; with region of dense, suberect setae (both dark and pale) beneath scrobal groove, along posterior margin, and often posterior to pronotal lobe and on anterior surface of mesepisternum; ventral integument sometimes sparsely covered with dark brown, branched setae, integument shining, but irregularly and densely punctate, integument between slightly raised, punctures at most 1 puncture diameter apart (females), or entire mesepisternum covered with pale yellow, branched setae (male). Paramedian bands distinct. Scutellum moderately to weakly bigibbous; axillar spines triangular, reaching midpoint of scutellum. T1 interspace relatively wide, quadrate to subtriangular or subovate, apical and basal bands interrupted medially, apical band narrowed in some specimens from Mexico, more robust in specimens further south; T2 with lateral, longitudinal band of pale setae absent (some specimens from Mexico) or forming weakly acute to acute angle with apical, transverse band of pale setae (Mexico and other localities). Female:

Pseudopygidial area semicircular, often darkly shining, with vague basal crescent of finer setae; S5 straight in profile; S2–4 with apicolateral bands pale yellow setae (often connected medially on S2–3). Male: Pygidial plate keyhole shaped, with moderately distinct apical downturned plate (basal ridge obscured by long, brown setae); S4–5 with apical fringes of setae brown on S5, pale golden on S4, S2–3 with apical bands of white setae (S3 with white setae slightly extending past apical margin).

Comments.—This species is very similar to *T. tepanecus* and, slightly less so, to *Triepeolus* sp. 110; all three species share the darkly shining pseudopygidial area, with a poorly differentiated basal region of finer, denser setae, and the sparse, short, erect, simple setae of the mesepisternum. Due to these similarities, *T. tepanecus*, *T. laticeps*, *Triepeolus* sp. 110 are grouped together in a group here termed the "*T. tepanecus* species group." See Table 5 for further characteristics of each species. *Triepeolus laticeps* additionally resembles *T. medusa*, but can be separated from that species by the more widely spaced, larger punctures on the mesepisternum of *T. laticeps* (versus the nearly contiguous, fine punctures on the mesepisternum of *T. medusa*). A specimen of this species was identified as "PCAM 8" by D. Yanega.

The original description of *Epeolus laticeps* is based on one male specimen; thus it is the holotype specimen by default.

Distribution.—EL SALVADOR: Quezaltepeque; GUATEMALA: Rabinal; MEXICO: Chihuahua, Coahuila, Colima, Durango, Guanajuato, Guerrero, Jalisco,

México, Michoacán, Morelos, Puebla, Querétaro, San Luis Potosí, Sonora, Zacatecas; USA: Arizona, New Mexico, Texas.

Floral Records.—*Simsia amplexicaulis* (Cav.) Pers., *Zinnia* sp., "Leguminosae", "blue aster", "Santa Maria weed".

Seasonal Records.—May 31 to October 30.

Specimens examined.—81 ♀, 3 ♂ (BERLIN, BERKELEY, CORVALLIS, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, MEXICO CITY, NEW YORK, RIVERSIDE, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS LOOMISORUM ROZEN

(Figs. 258, 259)

Triepeolus loomisorum Rozen 1989a: 14–18, Figs. 9, 22, 33–36 [Holotype: American Museum of Natural History; ♀, 13 mi SW Apache, Cochise Co., Arizona; September 1 1988], 17, 18, Fig. 25 [description of biology, description, illustration of egg]; Rozen 1989b: 14, 15, Figs. 19–23 [description, illustrations of first instar]; Rozen 2003: Fig. 53 [egg compared with others at same scale].

(Continued on p. 198)

Table 5. Characterization of the species within the *Triepeolus tepanicus* species group.

	T. laticeps	*T. tepanecus*	sp. 110
Clypeus midline	strong on entire length of clypeus, or rarely present only dorsally	strong on entire length of clypeus	present dorsally
Submedian band of setae	present, narrow or wide	absent or present, narrow	present, narrow
Scutum punctation	punctures irregular but very closely spaced, mostly nearly contiguous	punctures mostly separated by a puncture width or more (scutum shining)	punctures regularly spaced and nearly contiguous
Mesepisternum	punctures irregularly spaced (nearly contiguous to one puncture diameter apart), integument between often raised; erect, simple setae short yet conspicuous	punctures irregularly spaced (nearly contiguous to 2-3 puncture diameters apart), integument shining; erect, simple setae short and sparse	punctures nearly contiguous, with few intervening spaces of puncture diameter; erect, simple setae short and sparse
Axillar spine	triangular, often with small incurved free apical point; not reaching to slightly surpassing scutellar midpoint	triangular to sharply pointed; reaching or well surpassing scutellar midpoint	triangular, reaching scutellar midpoint
Propodeum	larger punctures on lateral fourth to fifth	larger punctures on lateral fifth	larger punctures on lateral third
Leg color	black, often with red mid and hind legs	black	black
T1 interspace	triangular, rarely wide ovate	triangular	wide ovate
T2 lateral longitudinal band of pale setae	present or absent	absent	present
Metasomal bands of pale setae	relatively wide, but sometimes narrow on T1	relatively narrow	relatively narrow
Pseudopygidial area	subquadrate to subovate, setae slightly denser basally	poorly defined basal boundary (ovate?), setae slightly suberect basally	subquadrate, setae very slightly denser basally
Distribution	Arizona to Texas, south to El Salvador	Nayarit southeast to Chiapas	Arizona south to Sinaloa

(Continued from p. 196)

Description.—Length ca. 6–8.5 mm; ITW 1.3–1.8 mm. Integument black, with red to orange on mandible, labrum, apical clypeus, scape, pedicel, F1 (sometimes also remaining flagellomeres), pronotal lobe, tegula, legs (excluding basal coxae, spurs, and sometimes scattered areas on femora and tibiae), and parts of ventral metasoma; dorsally with bands of setae pale yellow. Clypeus with weak midline and very weak larger punctures, densely covered with white setae in males. Mesepisternum lacking erect, simple setae; mostly covered with dense, pale, branched setae except for mediobasally with asetose, circular region of shining integument, with punctures nearly contiguous to separated by up to 3 puncture diameters in shining mediobasal region (females), or entirely covered with dense, white, branched setae (males). Paramedian bands distinct, tapering to anterior margin. Scutellum weakly bigibbous; axillar spines triangular, not or nearly reaching midpoint of scutellum. T1 interspace widely diamond-shaped; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: pseudopygidial area basally elongate into tear-shaped region of uniformly golden reflectance; S5 strongly downcurved. Male: Pygidial plate keyhole shaped, lacking distinct transverse basal ridge, but with weakly downturned apical plane; S3–5 with apical fringes of setae (brown on S5, white on S3–4); S2 with apical band of white setae.

Distribution.—MEXICO: Durango; USA: Arizona, New Mexico. Rozen (1989a) also examined specimens of this species from Texas.

Host Records.—*Xenoglossa eriocarpi* (Cockerell) [= *Tetraloniella* (*Tetraloniella*) *eriocarpi* (Cockerell)] (1 female specimen pinned with host specimen, apparently taken from nest entrance, Cochise Co., Arizona; Rozen, 1989a, adult parasite-host interactions at nest entrance, egg and larvae from cells; Rozen, 1989b, larva from cell); *Dieunomia* (*Epinomia*) *nevadensis* (Cresson) (1 specimen from nesting area, Cochise Co., Arizona).

Floral Records.—*Aster tanacetifolius* [= *Machaeranthera tanacetifolia* (H.B.K.) Nees], *Haplopappus* sp., *Helianthus petiolaris* Nutt., *Heterotheca* sp., *Sida abutifolia* P. Mill.

Seasonal Records.—August 14 to October 9.

Specimens examined.—86 ♀, 1 ♂ (DAVIS, LAWRENCE, LOS ANGELES, NEW YORK, RIVERSIDE, TEMPE, TUCSON).

TRIEPEOLUS LUNATUS (SAY)

(Figs. 26, 90, 121, 260–263, 479)

Epeolus lunatus Say 1825: 85[4] [♂, ♀; Missouri and Prairie des Chiens] [Type lost].

[4] The original description of *Epeolus lunatus* Say has been cited by Dalla Torre (1896) and Hurd (1979) as being from the year 1824, page 354. I have seen a microfiche reproduction of the original book in which Say's description is found. The book, the second volume of Keating's account of the Long Expedition, contains a series of appendices, the page numbers of which start at p. 1, despite their appearance after p. 248 of the main text, with the addition of two plates of figures at the beginning. I suspect that Dalla Torre continued counting the pages of the appendix from the main text, thus arriving at p. 354 for the original description of *E. lunatus*. It is unclear if the book that I saw was a later printing of an 1824 edition of this work, or if Dalla Torre and subsequent authors simply miscited the date of the publication; however, I can find no indication that the 1825 book is a second printing or new edition to a previous work.

Epeolus lunatus concolor Robertson 1898: 51 [Lectotype: Illinois Natural History Survey No. 8174; ♀, Carlinville, Macoupin Co., Illinois; July 24 1888]; Webb 1980: 108 [lectotype designation (by W. E. LaBerge)].

Triepeolus lunatus; Robertson 1901: 231.

Triepeolus concolor; Robertson 1903: 285.

Triepeolus nautlanus Cockerell 1904: 36 [Holotype: U. S. National Museum of Natural History No. 9705; ♂, (vicinity of San Rafael, Rio Nautla, Vera Cruz, Mexico)]. **new synonymy**

Triepeolus lunatus lunatus; Mitchell 1962: 472, Fig. 112 [redescription, illustration of scutellum, axillae].

Description.—Length ca. 9–13 mm (rarely as small as 7.5 mm); ITW 2.0–2.7 mm (rarely as small as 1.6 mm). Integument black, sometimes with the following red: mandible, labrum, apical clypeus, pronotal lobe, tegula, axillar spines, and/or legs (red especially in southern locales, blacker especially in specimens from Illinois, Kansas, and neighboring states); dorsal aspect with bands of setae pale yellow banding (deeper yellow in some specimens from Mexico), usually with banding becoming progressively paler yellow on more posterior terga. Clypeus with strong or rarely weak midline; with weak larger punctures; often sparsely (females) or densely (males) covered with medially-directed, white setae. Mesepisternum lacking erect, simple setae or with relatively short (ca. 0.5 OD or less), suberect, simple setae; females with dense, pale yellow, branched setae below scrobal groove, usually also between pronotal lobe and hypoepimeron, and sometimes on anterior surface of mesepisternum (southwestern specimens), males with more evenly dispersed, diffuse, pale

yellow, branched setae (males); punctation usually fairly dense, separated by up to one or two puncture diameter in some places. Paramedian bands distinct (somewhat reduced in midwestern specimens). Scutellum moderately to strongly bigibbous; axillar spines surpassing or rarely only reaching midpoint of scutellum, apical tip slightly incurved, sometimes with reddish coloration. T1 interspace strongly triangular to subquadrate; T2 with lateral bands absent (esp. midwest) or present (esp. southwest), forming acute or weakly acute angle with apical setae. Female: Pseudopygidial area semicircular to subquadrate, with distinct, flat, basal crescent; S5 very slightly downcurved; S2–4 with apical or apicolateral bands of pale setae. Male: Pygidial plate of moderate size, keyhole shaped, with strong basal transverse ridge; S4–5 with brown apical fringes; S2–3 with white apical bands of appressed setae (often slightly surpassing apical margin of S3).

Comments.—Although the type specimen of this species is no longer available for study, the meaning is clear from the original description and well understood by most workers making determinations in the collections that I have examined.

Based on the reduced, triangular T1 interspace, males of this species might be confused with *T. q. atlanticus* (separated by the shorter pronotal collar in *T. lunatus*—only ca. 1 OD in length in *T. lunatus*, versus the ca. 2 OD length of the pronotal collar in *T. q. atlanticus*), *T. simplex* (separated by the apical fringes on both S4 and S5 in *T. lunatus*), or *T. concavus*, *T. nevadensis*, or *T. remigatus* (separated by the distinct paramedian bands on the scutum in *T. lunatus*). This

species is extremely similar to *T. rufithorax*; the only notable difference between the two species is the greater amount of red coloration on the thorax in *T. rufithorax*. One specimen of *T. lunatus* from Chiapas, Mexico, was identified as "PCAM 40" by D. Yanega; another from Sonora, Mexico, was identified as "PCAM 3" by T. Griswold.

Distribution.—MEXICO: Chiapas, Chihuahua, Coahuila, Durango, San Luis Potosí, Sonora, Veracruz, Zacatecas; USA: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Maryland, Michigan, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, North Carolina, Ohio, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington D.C., West Virginia, Wisconsin.

Host Records.—*Melissodes* (*Melissodes*) *bimaculata* (Lepeletier)? (Mitchell 1962; Hurd et al 1980, evidence not given; John S. Ascher, in lit., 2003, 2006, observation of nests in numerous localities); *Melissodes* sp. (1 specimen, emerging from host nest, Champaign, Illinois).

Floral Records.—*Aplopappus spinulosus* [= *Machaeranthera pinnatifida* (Hook.) Shinners ssp. *pinnatifida* var. *pinnatifida*], *Asclepias syriaca* L., *A. tuberosa* L., *Aster pilosus* [= *Symphyotrichum pilosum* (Willd.) Nesom var. *pilosum*], *A. tanacetifolium* [= *Machaeranthera tanacetifolia* (H.B.K.) Nees], *Baccharis* sp., *Bahia absinthifolia* var. *dealbata* (Gray) Gray, *Baileya pleniradiata* Harvey & Gray ex Gray, *Bidens alba* (L.) DC. var. *radiata* (Schultz-

Bip.) Ballard ex T.E. Melchert, *Boltonia* sp., *Brauneria pallida* [= *Echinacea pallida* (Nutt.) Nutt.], *Callirhoe* sp., *Campanulastrum americanum* (L.) Small, *Ceanothus* sp., *Cirsium* sp., *Coreopsis major* Walt., *Chrysopsis camporum* [= *Heterotheca camporum* (Greene) Shinners var. *camporum*], *Cyrilla parvifolia* Raf., *Eriogonum deflexum* Torr., *Eupatorium purpureum* L., *Euphorbia marginata* Pursh, *Gaillardia pulchella* Foug., *Grindelia squarrosa* (Pursh) Dunal, *Helenium tenuifolium* [= *Helenium amarum* (Raf.) H. Rock var. *amarum*], *Helianthus annuus* L., *Helianthus atrorubens* L., *H. petiolaris* Nutt., *H. tuberosus* L., *Heliopsis helianthoides* (L.) Sweet, *Heterotheca subaxillaris* (Lam.) Britt. & Rusby, *Kallstroemia* sp., *Koellia flexuosa* (= *Pycnanthemum tenuifolium* Schrad.), *Lobelia siphilitica* L., *Lygodesmia juncea* (Pursh) D. Don ex Hook., *Medicago* sp., *Melilotus officinalis* (L.) Lam., *Monarda punctata* L., *Opuntia* sp., *Petalostemon occidentalis* [= *Dalea candida* Michx. ex Willd. var. *oligophylla* (Torr.) Shinners], *Platycodon grandiflorus* (Jacq.) A. DC., *Ratibida pinnata* (Vent.) Barnh., *Rudbeckia hirta* L., *R. laciniata* L., *Silphium perfoliatum* L., *Solidago* sp., *Spermacoce verticillata* L., *Sphaeralcea* sp., *Verbena brasiliensis* Vell., *V. hastata* L., *V. stricta* Vent., *Vernonia baldwinii interior* (Small) Faust, *Ve. fasciculata* Michx., *Veronicastrum virginicum* (L.) Farw., cantaloupe (= *Cucumis melo* L.), China aster [= *Callistephus chinensis* (L.) Nees], cotton (= *Gossypium* sp.), red clover (= *Trifolium pratense* L.), smartweed (= *Polygonum*), soybean (= *Glycine*).

Seasonal Records.—March 20 to October 7.

Specimens examined.—638 ♀, 313 ♂ (ANN ARBOR, AUSTIN, BERKELEY, BOULDER, DAVIS, GAINESVILLE, ITHACA, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, RIVERSIDE, SAN FRANCISCO, STARKVILLE, TEMPE, URBANA, WASHINGTON D.C.).

TRIEPEOLUS MARTINI (COCKERELL)

(Figs. 264, 265, 463, 480)

Epeolus remigatus var. *martini* Cockerell 1900: 362 [Holotype: U. S. National Museum of Natural History No. 18965; ♀, Romeroville (San Miguel Co.), New Mexico; August 6, 1899].

Triepeolus fortis Cockerell 1921: 3 [Holotype: American Museum of Natural History No. 25082; ♀, (cottonwood area at head of Dry Willow Creek), Wray (Yuma Co.), Colorado; about 40˚ 0'N, 102˚ 10'W; 3700 ft; August (18) 1919]. **new synonymy**

Triepeolus trilobatus Cockerell 1921: 7–8 [Holotype: American Museum of Natural History No. 25088; ♂, White Rock, near Boulder (Boulder Co.), Colorado; about 40˚ 3'N 105˚ 8'W; 5200 ft; August 13 1919]. **new synonymy**

Triepeolus (*Synepeolus*) *insolitus* Cockerell 1921: 6 [Holotype: American Museum of Natural History No. 25086; ♂, Pueblo (Pueblo Co.), Colorado; about 38˚ 10'N 104˚ 36'W; 4700 ft; August 9 1920]. **new synonymy**

Triepeolus martini; Hurd 1979: 2094.

Description.—Length ca. 12–16 mm; ITW 2.6–3.1 mm. Integument black, with red on part of mandible and F1, sometimes with red to orange on labrum, scape, pedicel, and part or most of legs (excluding coxae and spurs); dorsally with bands of setae pale yellow. Clypeus with strong midline and weak

larger punctures, sometimes covered with sparse, brown setae. Mesepisternum lacking erect, simple setae; with dense, pale, branched setae between hypoepimeron and pronotal lobe (sometimes also beneath scrobal groove); punctures rough, nearly contiguous, integument between punctures raised, somewhat tuberculate. Paramedian bands strongly demarcated, joined laterally to apicolateral setae, forming anchor shape. Scutellum strongly bigibbous; axillar spines surpassing midpoint of scutellum, slightly incurved. T1 interspace triangular to subrectangular; T2 with lateral, longitudinal band of pale setae forming weakly acute angle with apical, transverse band of pale setae. Mesosoma and metasoma venter entirely black. Female: Pseudopygidial area poorly differentiated from rest of T5, formed by flattened, triangular plane of coarser, dark setae, with golden reflectance along apical margin; T5 lacking lateral patch of white setae (rarely with small patch of sparse white setae lateral to pseudopygidial area); S5 straight in profile. Male: Pygidial plate relatively wide, keyhole shaped, with distinct basal transverse ridge and moderately downturned apical plate; S4–5 with dark brown apical fringes of setae; S2–3 mostly dark brown, with faint bands white setae on apical margins.

Comments.—This species was placed in the subgenus *Synepeolus* by Cockerell, based on the presence of only two submarginal cells in the holotype specimen; however, this is a variable character within the species. Females of *T. martini* are easily recognizable by the distinctive, dark, perfectly triangular pseudopygidial area.

Distribution.—MEXICO: Chihuahua; USA: Arizona, Colorado, Kansas, Nebraska, New Mexico, Texas.

Host Records.—*Nomia bakeri* Cockerell [= *Dieunomia* (*Epinomia*) *nevadensis bakeri* (Cockerell)] (1 specimen, noted by C. Hicks as "flying over ground where many nest, especially *Nomia bakeri*," from Colorado).

Floral Records.—*Gutierrezia sarothrae* (Pursh) Britt. & Rusby, *Helianthus annuus* L., *H. petiolaris* Nutt., *Melilotus alba* [= *Melilotus officinalis* (L.) Lam.], *Prionopsis ciliata* [= *Grindelia papposa* Nesom & Suh].

Seasonal Records.—July 17 to September 17.

Specimens examined.—56 ♀, 3 ♂ (BOULDER, DAVIS, LAWRENCE, LOS ANGELES, NEW YORK, NEW YORK-ASCHER, SAN DIEGO, URBANA, WASHINGTON D.C.).

TRIEPEOLUS MEDUSA COCKERELL

(Figs. 266, 267)

Triepeolus medusa Cockerell 1917b: 301–302 [Holotype: U. S. National Museum of Natural History No.22895; ♀, Distrito Federal, Mexico; "7 + 8.10" (October 7–8?)].

Description.—Length ca. 10.5–11.5 mm; ITW 2.2–2.7 mm. Integument black, with red on part of mandible, orange on most of middle and hind legs (excluding spurs), partially on front leg, antenna entirely brown; dorsally with bands of setae pale yellow. Clypeus with faint midline and larger punctures, covered with dense white setae in males. Mesepisternum with very sparse, short,

erect, simple setae; dorsal half, excluding hypoepimeron, with well-defined area of dense, yellow, branched setae; ventrally with sparser, black, branched setae; integument very densely, roughly punctate, punctures small and nearly contiguous (females), or mesepisternum covered with dense, pale, branched setae (sparser on hypoepimeron; males). Paramedian bands distinct (most females) or laterally contiguous with diffuse pale setae on anterior of scutum. Scutellum moderately to weakly bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 wide subquadrate to ovate; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular, with basal region of strongly shining, silvery, fine setae, gradually grading to coarser, less dense apical setae; S5 straight in profile; venter of metasoma dark brown except for patches of white setae laterally on S4–5, extended medially, sparser on S5, and sometimes diffuse medially on S3. Male: Pygidial plate keyhole shaped, with distinct basal transverse ridge and apical downturned plate; S4–5 with brown and white apical fringes of setae, S2–3 with apical bands of white setae.

Comments.—This species is similar to *T. townsendi*, but *T. medusa* has longer erect, simple setae on the mesepisternum and the pseudopygidial area has a vague basal shining crescent. *Triepeolus medusa* is also similar to *T. laticeps*, but the lower mesepisternum is not as shiny as in that species, and the clypeus has only a faint midline. Finally, *T. medusa* is similar to *Triepeolus* sp. 179, but the setae of the pseudopygidial area are not as uniform as in that species, there are

more terga that have the apical transverse bands of pale yellow setae medially interrupted, and the erect setae on the face are more prevalent.

Distribution.—MEXICO: Guanajuato, Hidalgo, Jalisco, México, Nayarit, Sonora, Distrito Federal; USA: New Mexico.

Floral Records.—*Bidens pilosa L.*, *Cosmos* sp. *Heterotheca subaxillaris* (Lam.) Britt. & Rusby.

Seasonal Records.—July 12 to October 25.

Specimens examined.—8 ♀, 3 ♂ (LAWRENCE, LOGAN, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS MICHIGANENSIS MITCHELL

(Figs. 268, 269)

Triepeolus michiganensis Mitchell 1962: 473–474 [Holotype: U. S. National Museum of Natural History No.75244; ♀, Shiwassee Co., Michigan; September 3 1950].

Description.—Length ca. 8–9 mm; ITW 1.9–2.0 mm. Integument black, with red to orange on labrum, apical mandible, entirely or basally on antenna, and partially on legs, sometimes on tegula, rarely on pronotal lobe; dorsal aspect with bands of setae pale grey white. Clypeus with distinct midline and vague larger punctures, asetose or covered with medially-directed white setae (denser on basal half, especially in males). Mesepisternum lacking erect setae, punctures nearly contiguous to separated by 1 puncture diameter; with white, branched setae mostly restricted to dorsal half to fourth of lateral surface (absent on

hypoepimeron) as well as anterior surface (males with setae denser). Paramedian bands distinct (females) or connected laterally to areas of diffuse setae on anterior margin of scutum (males). Scutellum moderately to strongly bigibbous; axillar spines triangular, not incurved apically, reaching scutellar midpoint. T1 interspace widely subquadrate; T2 with lateral band of pale setae forming acute angle with apical transverse band of pale setae; T1–3 apical transverse bands of setae interrupted medially. Female: Pseudopygidial area subquadrate, with distinct basal crescent of silvery shining setae; S5 very slightly downcurved apically or straight; S2–4 with white appressed setae on apical margin. Male: Pygidial plate of moderate size with slight emargination on lateral margins and weak or strong basal transverse ridge; S4–5 with brown apical fringes (white laterally on S4); S2–4 with white setae on apical margins.

Comments.—The males of this species are similar to *T. obliteratus* (see comments under that species). Females are recognized by the combination of their small size, white bands of setae on the metasoma, and the distinct basal crescent of shining setae on the pseudopygidial area.

Distribution.—USA: Michigan, New Hampshire, New York.

Host Records.—*Melissodes* (*Eumelissodes*) *denticulata* Smith (John S. Ascher, in lit., 2003, observation of nesting site).

Floral Records.—*Solidago* sp.

Seasonal Records.—July 26 to September 3.

Specimens examined.—5 ♀, 2 ♂ (ITHACA, NEW YORK-ASCHER, PHILADELPHIA, WASHINGTON D.C.).

TRIEPEOLUS MICROPYGIUS ROBERTSON

(Figs. 270, 271)

Triepeolus micropygius Robertson 1903: 286 [Lectotype: Illinois Natural History Survey No. 23531; ♀, Carlinville, Macoupin Co., Illinois; September 29 1902]; Webb 1980: 110 [lectotype designation (by W. E. LaBerge)].

Triepeolus micropygius micropygius; Mitchell 1962: 474–475.

Description.—Length ca. 10–12 mm (rarely as small as 8 mm); ITW 1.9–2.4 mm (rarely as small as 1.4 mm). Integument black, with red apical half of mandible, sometimes with orange labrum and clypeus, usually with orange F1, tegula, and legs (black in specimen from Mississippi); dorsal aspect with bands of setae pale yellow. Clypeus with faint midline (stronger dorsally) and faint larger punctures, clypeus sparsely covered with white setae (sometimes asetose in more eastern specimens). Mesepisternum with relatively short, erect, simple setae (ca. 0.25 OD); usually mostly covered with pale yellow, appressed, branched setae, this setae sparser ventrally (lectotype specimen mostly lacking appressed setae ventrally); punctures dense and small, ventrally nearly contiguous to separated by one puncture diameter (up to three puncture diameters in lectotype). Paramedian bands distinct and narrow (lectotype specimen and a few others) or joined laterally to appressed setae on anterior margin of scutum. Scutellum weakly

bigibbous; axillar spines triangular, reaching midpoint of scutellum. T1 interspace widely ovate to wide subrectangular; T2 with lateral bands weakly to strongly acute, this angle correlated with overall width of tergal bands [some specimens' banding enlarged by diffuse pale setae, and others (including lectotype) with banding rather narrow (reminiscent of *T. helianthi*)]. Female: Pseudopygidial area (and T5 in general) narrowed apically, basally with dense, silvery, pilose setae, this silvery setae extending laterally towards apical margin, partially enclosing small, rounded apical region of sparse, coarse setae (apical margin straight in specimen from Mississippi); S5 distinctly downturned, also narrowed apically; S2–4 with apical bands white setae (rarely only on S2–3 or S3–4). Male: Unknown.

Comments.—This species resembles *T. fraserae* due to the small, rounded pseudopygidial area with the distinct basal region of silvery shining setae; however the S5 and T5 of *T. micropygius* are conspicuously narrowed distally, the S5 is much more strongly downcurved, the pseudopygidial area is even more distinctly rounded, and the erect, simple setae of the mesepisternum are much shorter in *T. micropygius* (0.25 OD vs. greater than 0.5 OD in *T. fraserae*). The rounded pseudopygidial area and the downcurved S5 resemble those of the *T. verbesinae* species group; however the small size of the pseudopygidial area and the general banding pattern of the metasoma (i.e., often the T1 transverse bands of pale setae are medially interrupted, and the T2 lateral band of pale setae forms only a weakly acute angle with the apical transverse

band—although in some exceptionally setose specimens this angle is strongly acute) differentiate this species from the *T. verbesinae* group. The distribution of this species is largely western, with only one known specimen from Illinois (the lectotype specimen). The lectotype specimen is less setose than many, but not all, of the other examined specimens. In addition, I have one specimen from Mississippi (repository: Starkville) that agrees with *T. micropygius* in most characters, except it has black legs and tegula, and is also quite sparsely setose.

Distribution.—USA: Arizona, California, Colorado, Idaho, Illinois, Mississippi, Montana, Nebraska, Nevada, New Mexico, Oregon, Utah.

Floral Records.—*Aster tanacetifolius* [= *Machaeranthera tanacetifolia* (H.B.K.) Nees], *Chrysothamnus* sp., *Grindelia squarrosa* (Pursh) Dunal, *Melilotus* sp., *Oligoneuron rigidum* (L.) Small, *Solidago* sp.

Seasonal Records.—August 19 to October 23.

Specimens examined.—45 ♀ (BOULDER, CORVALLIS, DAVIS, LAWRENCE, LOGAN, NEW YORK, SAN FRANCISCO, STARKVILLE, URBANA, WASHINGTON D.C.).

TRIEPEOLUS MITCHELLI HURD

(Fig. 272)

Triepeolus sublunatus Mitchell 1962: 483–484 [nec Cockerell] [Holotype: U. S. National Museum of Natural History (on indefinite loan from North Carolina State University); ♂, Marion (McDowell Co.), North Carolina; July 27 1924; *Coreopsis stelista*].

Triepeolus mitchelli Hurd 1979: 2094 [replacement name].

Description.—Length ca. 11 mm; ITW 1.9 mm. Integument black; dorsal aspect with bands of setae pale grey/white. Clypeus with strong midline, mostly covered with white setae. Mesepisternum lacking erect, simple setae, with punctures nearly contiguous to spaced up to 3 puncture diameters apart, integument between relatively flat; with dense, white, branched setae on dorsal third (excluding hypoepimeron), less dense on anterior surface of mesepisternum, relatively sparse on rest of lateral surface. Paramedian bands barely contiguous with diffuse, weak area of white setae on anterior margin of scutum. Scutellum moderately bigibbous, axillar spines triangular, reaching scutellar midpoint. T1 interspace relatively small, triangular/subovate. T2 with lateral bands forming 90 degree angle with apical transverse band of setae. Female: Unknown. Male: Pygidial plate moderate size, with distinct basal transverse ridge. S4–5 with brown apical fringes plus white setae laterally on S4; S2–3 with apical bands of white setae.

Comments.—This species is very similar to *T. georgicus* Mitchell, due to the white setal banding on the black body, the clypeus of normal length with strong midline, the mesepisternum lacking erect, simple setae and the shining integument which is moderately punctate and smooth (unlike *T. atripes* Mitchell, which it also superficially resembles). It differs from *T. georgicus* by the broader metasomal banding and the triangular T1 interspace; however this is based on the male specimen, and it is not particularly rare to find male specimens with greatly

expanded areas of pale setae on the metasoma. Additionally, the scutellum is not nearly as biconvex in *T. mitchelli* as in *T. georgicus*, although this character also can also vary within a species. Of note is the wide spacing of the mesepisternal punctures in *T. mitchelli*, which is rare among male specimens of *Triepeolus* species (particularly those with pale grey to white banding). More specimens of *T. georgicus* and/or *T. mitchelli*, especially from more northerly distributions, may provide further evidence on whether the two species should be synonymized.

Distribution.—USA: North Carolina.

Floral Records.—*Coreopsis major stellata* [= *Coreopsis major* Walt.].

Seasonal Records.—July 27.

Specimens examined.—1 ♂ (WASHINGTON D.C.).

TRIEPEOLUS MOJAVENSIS LINSLEY

(Figs. 273, 274, 482)

Triepeolus mojavensis Linsley 1939: 2–4 [Holotype: California Academy of Sciences No. 4801; ♀, 1 mi N Deep Creek (Mojave Desert near Hesperia, San Bernardino Co.) California; April 26 1936].

Description.—Length ca. 10–12 mm; ITW 2.2–2.8 mm. Integument black; dorsally with bands of setae white. Preoccipital carina very reduced. Clypeus with weak midline dorsally, lacking larger punctures, mostly asetose except for few long, brown setae. Head and mesosoma prominently covered with erect, simple setae. Mesepisternum densely covered with dark, long, erect, simple

setae; punctures beneath not distinct, integument furrowed (rugose). Paramedian bands poorly discernable, diffuse, joined with diffuse, white setae on anterior scutum. Mesosoma and metasoma venters entirely black. Scutellum moderately bigibbous; axillar spines rounded, not reaching midpoint of scutellum. T1 almost entirely covered by white setae except for vague black oval mediobasally (basal transverse band of pale setae present); rest of terga with apical bands uninterrupted; T2 with lateral, longitudinal band of pale setae absent, but apical, transverse band of pale setae slightly widened laterally, resulting in vague, black, semicircular region at base of tergum. Female: Pseudopygidial area subrectangular, with apical, transverse row of stout setae, basally with fine black setae, poorly differentiated from rest of T5; S5 straight in profile. Male: Unknown.

Comments.—This species is very similar to *T. dacotensis*, but the basal transverse band of pale setae on the T1 (present in *T. mojavensis* and absent in *T. dacotensis*) and the punctation of the mesepisternum are different.

Distribution.—USA: California.

Host Records.—*Anthophora linsleyi* Timberlake (Linsley & MacSwain, 1942, adults observed exploring burrows, and presumably nests were excavated to obtain parasitism rate in a population near Bakersfield, California).

Seasonal Records.—April 26 to May 31.

Specimens examined.—3 ♀ (SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS MONARDAE MITCHELL

(Figs. 275, 276)

Triepeolus monardae Mitchell 1962: 475, Fig. 112, [Holotype: U. S. National Museum of Natural History No. 75246; ♂, Wilmington (New Hanover Co.), North Carolina; September 12 1932].

Description.—Length ca. 15–18 mm; ITW 2.9–3.5 mm. Integument black, with red on apical half of mandibles and slight red on outer F1; dorsal aspect with bands of setae pale yellow. Clypeus with strong midline and weak larger punctures, densely covered with white setae in males. Mesepisternum with short, erect, simple setae; punctures nearly contiguous to separated by up to .5 puncture diameter; integument between punctures raised; with dense, white, branched setae on dorsal third (sparser on hypoepimeron in females). Paramedian bands distinct in both sexes. Scutellum strongly bigibbous; axillar spines strongly pointed, weakly incurved, surpassing midpoint of scutellum. T1 interspace widely rectangular/subquadrate; T2 with lateral setae forming acute angle with apical transverse band pale setae. Female: Pseudopygidial area subovate, with uniformly shining, dark, "glossy" setae; S5 not downcurved; S2–3 (sometimes also S4) with white setae on apicolateral margins. Male: Pygidial plate relatively wide, keyhole shaped, with distinct basal transverse ridge. S4–5 with apical fringes setae brown (paler brown with white laterally on S4, sometimes with small area of white setae on S5); S2–3 with white apical bands of setae.

Comments.—This species is distinctive for its large size and pattern of pale setal bands on the metasoma.

Distribution.—USA: Florida, Georgia, North Carolina.

Floral Records.—*Monarda punctata* L., white goldenrod (= *Solidago bicolor* L.).

Seasonal Records.—August 28 to September 12.

Specimens examined.—3 ♀, 3 ♂ (RALEIGH, NEW YORK, WASHINGTON D.C.).

TRIEPEOLUS NEVADENSIS (CRESSON)

(Figs. 277–279)

Epeolus nevadensis Cresson 1878: 86 [Lectotype: Academy of Natural Sciences No. 2220; ♀, Nevada]; Cresson 1916: 125 [lectotype designation].

Triepeolus nevadensis; Robertson 1901: 231.

Description.—Length ca. 12.5–14 mm; ITW 2.6–2.9 mm. Integument black, with red on basal half of mandible, sometimes with orange labrum and F1; dorsal aspect with bands of setae yellow. Clypeus shining, mostly asetose, with large punctures, lacking midline. Preoccipital carinae on gena and posterior margin of head. Mesepisternum lacking erect, simple setae, with distinct area of yellow, branched setae on dorsal half to third (including hypoepimeron), ventrally with brown, branched setae; punctures small and contiguous. Scutum and scutellum shining; scutum with dense band of setae on anterior fourth, with

paramedian bands barely distinct from dense anterior setae. Scutellum flattened and somewhat extended posteriorly; axillar spine not reaching midpoint of scutellum, rounded apically. T1 interspace distinctly rectangular. T2 with lateral setae forming conspicuous right angles with apical setae. Mesosoma and metasoma venter entirely dark brown (except males with white apical band of setae on S3). Female: Pseudopygidial area uniformly dark, "glossy"; poorly differentiated from rest of T5 (T5 usually lacking pale setae, but sometimes with pale setae lateral to pseudopygidial area), S5 not downcurved. Male: Pygidial plate moderate size, keyhole shaped, with strong basal transverse ridge, forming downturned apical plate; S4–5 with brown apical fringes; S3 with white apical band of setae (sometimes brown medioapically), setae medially weakly surpassing apical margin.

Comments.—*Triepeolus nevadensis* is superficially similar to *T. concavus*, but can be separated by the following characters of *T. nevadensis*: the scutum is shining, the paramedian bands are distinct from the yellow setae on the anterior margin of the scutum (though weakly developed), the scutellum is flattened and somewhat extended posteriorly, the clypeus is shining with distinct larger punctures, the T1 interspace is strongly rectangular, and the T2 with lateral setal band forms a 90 degree angle with the apical transverse band of setae. The female pseudopygidial area of *T. nevadensis* is completely different from that of *T. concavus*, appearing poorly differentiated from the rest of T5, darkly shining, flat, and quadrangular; also, the S5 is not downcurved. *Triepeolus nevadensis* is

also similar to *T. remigatus*, but in *T. nevadensis* the paramedian bands are not so strongly developed as in *T. remigatus*, the scutum is more distinctly shining, the scutellum is more flattened and extended posteriorly, and the T1 interspace is distinctly rectangular (as opposed to ovate or subtriangular in *T. remigatus*). The males have white banding only on S3 (as opposed to both S2 and S3). The female pseudopygidial areas are similar, but the species can be differentiated by the other characters listed above. *Triepeolus nevadensis* is also similar to *T. robustus* in overall appearance, but can be distinguished from that species by the lack of dense, erect setae on the upper face, which, in *T. robustus*, causes the clypeus to appear to be recessed.

Distribution.—MEXICO: Chihuahua, Durango; USA: Georgia, Nevada, North Carolina, Oklahoma, Texas.

Floral Records.—*Monarda citriodora* Cerv. ex Lag., *M. punctata* L., *Vernonia glauca* (L.) Willd.

Seasonal Records.—May 3 to September 27.

Specimens examined.—20 ♀, 2 ♂ (DAVIS, LAWRENCE, NEW YORK, PHILADELPHIA, RALEIGH, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS NIGRIHIRTUS MITCHELL

(Figs. 280–283)

Triepeolus nigrihirtus Mitchell 1962: 476–477 [Holotype: U. S. National Museum of Natural History No. 400195 (on indefinite loan from North Carolina State University); ♂, Merry Oaks (Clatham Co.), North Carolina; May 27 1926].

Description.—Length ca. 10 mm; ITW 2.3–2.5 mm. Integument black (♀ specimen) or reddish brown (♂ HT, possibly due to preservation?), tegula with transparent outer margin; dorsal aspect with bands of setae pale white. Clypeus with slight midline dorsally; shining with rather deeply impressed punctures (no larger punctures present); very sparsely setose in female, male with long white setae apicomedially. Supraclypeal area between antennae rather swollen, produced laterally (especially in ♀ specimen). Vertex with punctures small and distantly spaced, especially near lateral ocellus. Mesepisternum with long, minutely-branched, erect to semi-erect, white setae on anterior and posterior margins of mesepisternum, between pronotal lobe and hypoepimeron, and ventrally below hypoepimeron; integument shining, with small, deeply impressed punctures, separated by up to 1 puncture diameter. Pronotal collar dorsally with long, sparse, erect setae directed laterally and parted at midpoint. Paramedian bands apparently absent; anterior third to half of scutum with diffuse, erect to suberect setae. Scutellum moderately bigibbous; axillar spines triangular, reaching midpoint of scutellum. T1 interspace widely ovate, T2 with lateral bands forming acute angle with transverse apical band of setae (worn in ♀ specimen). Female: Pseudopygidial area long ovate, basally well-defined from rest of T5, with dark, short setae; apically with tuft of longer, golden, shining setae; S5 faintly downcurved apically; S2–4 with white setae on apical margins. Male: Pygidial plate keyhole shaped, with distinct basal transverse ridge; S4–5

with pale golden brown apical fringes; S2–3 with white apical bands (medially curving basally on S3).

Comments.—Despite the disparate collection localities for the male holotype and the sole female specimen from Texas, there is evidence supporting the hypothesis that these two specimens are conspecific: the diffuse, erect setae anteriorly on the scutum, the carinate posterior margin of the head, and the shape of the T1 interspace. Both specimens were collected relatively early in the year (late April and late May). *Triepeolus nigrihirtus* superficially resembles *T. mojavensis* and *T. dacotensis* in overall appearance, but can be separated from the latter two species by the strong preoccipital carina on the gena and posterior margin of the head, and by the completely different pseudopygidial area, which is unique among *Triepeolus* species.

Distribution.—USA: North Carolina (holotype specimen), Texas ("Magnolia, April 30 1953, L D Beamer")

Floral Records.—(Texas specimen): *Verbena officinalis* L.

Seasonal Records.—April 30 to May 27.

Specimens examined.—1 ♀, 1 ♂ (LAWRENCE, WASHINGTON D.C.).

TRIEPEOLUS NISIBONENSIS GENARO

(Figs. 284, 285)

Triepeolus nisibonensis Genaro 2001: 1033–1034, Figs. 18–20 [Holotype: Florida State Collection of Arthropods; ♂, Nisibón, La Altagracia, Dominican Republic; May 5–7 1978; near cacao planting; flight trap].

Description.—Length ca. 8.5–11.5 mm; ITW 2.1–2.2 mm. Integument black, with dark red on part of mandible, orange brown on F1; dorsally with bands of setae yellow to white. Clypeus with faint midline (covered with pale yellow to white setae). Posterior margin of head with distinct medial notch. Mesepisternum lacking erect, simple setae, with very distinct circular area of dark, branched setae surrounded by pale yellow to white, branched setae; punctation mostly obscured by setae but apparently nearly contiguous. Paramedian bands distinct, well separated from anterior margin in white-banded specimen, or tapering to anterior margin in yellow-banded (i.e., holotype) specimen. Scutellum strongly bigibbous; axillar spines strongly pointed and incurved, apical point reaching or slightly exceeding posterior margin of scutellum. T1 interspace very wide subovate (apical bands suggestive of *T. verbesinae*); T2 with lateral, longitudinal band of pale setae forming weakly acute angle with apical, transverse band of pale setae. Female: Unknown. Male: Pygidial plate narrow and long, with strong basal transverse ridge and apical downturned plate; S4–5 with apical fringes of setae brown on S5 (sometimes with white laterally), white on S4; S2–3 with apical bands of white setae.

Comments.—This species can be differentiated from the other species of *Triepeolus* by the notched dorsal margin of the head.

Distribution.—DOMINICAN REPUBLIC: La Altagracia.

Seasonal Records.—May 5 to 7.

Specimens examined.—2 ♂ (LAWRENCE, GAINESVILLE).

TRIEPEOLUS NORAE COCKERELL

(Figs. 286, 287)

Triepeolus norae Cockerell 1907c: 59 [Holotype: U. S. National Museum of Natural History No. 100034; ♀, Mesilla Park (Dona Ana Co.), New Mexico; May 16; *Sphaeralcea lobata*]; Linsley 1962: 150, 152, 161 [biological data on sleeping aggregations]; Hurd et al. 1980: 131 [Table of flight times].

Description.—Length ca. 7–11 mm; ITW 1.6–2.2 mm. Integument black, with dark reddish brown to orange on part of mandible, part or entire labrum, apical margin of clypeus, part or entire scape, pedicel, and F1, rarely on pronotal lobe, orange on tegula and legs (excluding basal coxae and usually spurs); dorsally with bands of setae pale yellow. Clypeus shining, with glabrous midline present and distinct larger punctures. Mesepisternum with sparse, short, erect, simple setae, mostly covered with appressed, white, branched setae, but medioventrally with circular area (asetose or covered with diffuse, black, branched setae); punctures nearly contiguous to separated by 1 puncture diameter in some areas, integument between punctures raised, tuberculate. Paramedian bands distinct or barely contiguous with pale setae on anterior margin of scutum. Scutellum strongly to moderately bigibbous; axillar spines reaching midpoint of scutellum, triangular, usually with apical point directed inward. T1 interspace widely ovate; T2 with lateral, longitudinal band of pale setae forming strongly

acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area subtriangular, with two distinct regions usually of approximately equal size (dorsally with shining silvery setae, ventrally with coarse, longer setae); S5 straight in profile or faintly downcurved apically. Male: unknown.

Comments.—*Triepeolus norae* is distinguishable by its pseudopygidial area, which has a relatively large basal region of silvery reflectance, the apical margin of which is nearly straight in most specimens, causing the entire area to have a somewhat triangular appearance (as opposed to the typical crescent-shaped basal region of silvery setae in many *Triepeolus* species). This species was identified as "PCAM 20" by T. Griswold.

Distribution.—Mexico: Chihuahua, Coahuila, Durango, Zacatecas; **USA**: Arizona, California, Nevada, New Mexico, Texas, Utah.

Floral Records.—*Acacia greggii* Gray, *Aplopappus gracilis* [= *Machaeranthera gracilis* (Nutt.) Shinners], *Aster spinosus* [= *Chloracantha spinosa* (Benth.) Nesom], *Baileya multiradiata* Harv., *Dyssodia aurea* [= *Thymophylla aurea* (Gray) Greene ex Britt. var. *aurea*], *Eriogonum* sp., *Haplopappus* sp., *Helianthella* sp., *Lepachys tagetes* [= *Ratibida tagetes* (James) Barnh.], *Melilotus alba* [= *Melilotus officinalis* (L.) Lam.], *Pectis angustifolia* Torr., *Poliomintha incana* (Torr.) Gray, *Prosopis juliflora* (Sw.) DC., *Psorothamnus scoparius* (Gray) Rydb., *Sida* sp., *Sphaeralcea ambigua* Gray, *S. angustifolia* (Cav.) G. Don.

Seasonal Records.—April 15 to October 21.

Specimens examined.—157 ♀ (AUSTIN, BERKELEY, CHAMELA, CORVALLIS, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, LOS ANGELES, MEXICO CITY, NEW YORK, RIVERSIDE, SAN FRANCISCO, TEMPE, URBANA, WASHINGTON D.C.).

TRIEPEOLUS OCCIDENTALIS (CRESSON)

(Figs. 288, 289, 483)

Epeolus occidentalis Cresson 1878: 87–88 [Lectotype: Academy of Natural Sciences No. 2224; ♀, Colorado]; Cresson 1916: 126 [lectotype designation].

Triepeolus occidentalis; Cockerell 1904: 38.

Description.—Length ca. 9.5–13 mm; ITW 1.8–2.8 mm. Integument black, with dark reddish brown to orange on part of mandible, part or entire labrum, and F1, sometimes on apical margin of clypeus, scape, and pronotal lobe, orange on tegula and legs (excluding basal coxae and spurs); dorsally with bands of setae pale yellow. Clypeus with faint midline and faint large punctures. Mesepisternum with very short, sparse, erect, simple setae; with contiguous, minute punctures; with dense, white, branched setae on upper third (lacking or sparse on hypoepimeron) and sometimes along margins ventrally; entire ventral half or medioventral area asetose or covered with sparse, brown, branched setae. Paramedian bands distinct and long. Scutellum moderately bigibbous; axillar spines triangular, surpassing scutellum midpoint, with apical point directed inwardly. T1 interspace widely ovate, with basal and apical transverse bands of

pale setae not or little interrupted medially; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular to subtriangular with large amount of basal and lateral shining silvery setae, mostly enclosing median region of coarse setae; shining setae mediobasally often with slight notch; T5 lateral white setae extending basally, forming black median band basal to pseudopygidial area; S5 slightly downcurved at apex; S2–4 with white setae (sometimes faint) at apex.

Comments.—This species is similar to *Triepeolus* sp. 95; the two can be differentiated by the pseudopygidial area, in which the basal shining setae is less distinctly differentiated form the apical coarse setae in *T. occidentalis*, the mesepisternum, which is more densely punctate in *T. occidentalis*, and by the axillar spines, which are more robust in *T. occidentalis*.

Distribution.—USA: Colorado, Idaho, Kansas, North Dakota.

Host Records.—*Melissodes mizeae* Cockerell [= *Melissodes* (*Eumelissodes*) *menuachus* Cresson]? (Hicks, 1926, two females observed entering and spending time in nests of host).

Floral Records.—*Grindelia squarrosa* (Pursh) Dunal.

Seasonal Records.—August 28 to October (day unspecified).

Specimens examined.—24 ♀ (BOULDER, LOGAN, NEW YORK, WASHINGTON D.C.).

TRIEPEOLUS PAENEPECTORALIS VIERECK

(Figs. 290–293)

Triepeolus paenepectoralis Viereck 1905: 278–280 [Holotype: Academy of Natural Sciences No. 10124; ♀, Vancouver, British Columbia), Canada].

Triepeolus amandus Cockerell 1921: 10 [Holotype: American Museum of Natural History No. 25092; ♂, Meeker (Rio Blanco Co.), Colorado; about 40˚ 2'N 107˚ 55'W; 6200 ft; July (21) 1919; (*Grindelia serrulata*)]. **new synonymy**

Triepeolus alpestris Cockerell 1921: 13 [Holotype: American Museum of Natural History No. 25097; ♀, Leadville (Lake County), Colorado; about 39˚ 15'N 106˚ 16'W; 10,300 ft; August (4) 1919; (*Lepidium alyssoides*)]. **new synonymy**

Triepeolus vandykei Cockerell & Sandhouse 1924: 307 [Holotype: California Academy of Sciences No. 1599; ♀, Millbrae (San Mateo Co.), California; September 1 1912]. **new synonymy**

Description.—Length ca. 7–12 mm; ITW 1.4–2.6 mm. Integument black, with red on part of mandible, dark reddish brown rarely on legs, orange on F1; dorsally with bands of setae pale yellow. Clypeus with faint to absent midline, with larger punctures visible if not covered with brown setae; or entirely covered with white setae in males. Mesepisternum with erect, simple setae (sometimes sparse and short), dorsal half covered with pale yellow, branched setae (sparser or with brown, branched setae on hypoepimeron), ventrally with punctures relatively small, dense (separated by less than 1 puncture diameter in some specimens), integument shining, sometimes medioventrally with short, relatively dense brown setae interspersed with golden, short, suberect setae (females), or entirely covered

with white setae in males. Paramedian bands distinct or barely contiguous with lateral setae. Scutellum weakly bigibbous, slightly extended posteriorly; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace rectangular, apical and basal bands not or only slightly interrupted medially; T2 with lateral, longitudinal band of pale setae forming 90 degree angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular with distinct shining basal crescent, extending apically along lateral margins to partially enclose circular region of stout setae; S5 not or very slightly downcurved. Male: Pygidial plate rather small, triangular, with rather indistinct transverse basal ridge and apical downturned plate; S4–5 with brown apical fringes of setae, S2–3 with white apical bands somewhat diffuse (see comments, below).

Comments.—*Triepeolus paenepectoralis* is a variable species, encompassing a number of intergrading forms. The most widespread form is smaller in size, resembling *T. subalpinus* in overall appearance (ca. 1.4–2.0 mm ITW), while a couple of other forms are larger, approaching a general look of *T. texanus* (ca. 1.8–2.6 mm ITW). Of the two larger forms, one is most abundantly found in California, and has relatively broad bands of yellow setae on the metasoma; this form corresponds to the synonymized name *T. vandykei*. The other larger form is found mostly in Oregon and Washington, and has slightly narrower bands of yellow setae on the metasoma. See comments under *T. subalpinus* and *T. texanus* for characters separating *T. paenepectoralis* from them. The description of the male is based on one specimen from Colorado (the

holotype of *T. amandus*) and caution should be taken before applying this description to the males of *T. paenepectoralis* as a whole. In particular, the shape of the pygidial plate is unusual and may be due to wear, or may represent an anomaly within the species.

This species is very similar to *T. eldoradensis* and *T. argyreus*; Table 4 gives potentially distinguishing features of each species.

Distribution.—CANADA: Alberta, British Columbia; USA: California, Colorado, Idaho, Nevada, Oregon, Utah, Washington, Wyoming.

Host Records.—*Melissodes* (*Eumelissodes*) *microsticta* Cockerell? (2 specimens at nest site, Kitsap Co., Washington).

Floral Records.—*Chrysothamnus* sp., *Cirsium lanceolatus* [= *Cirsium vulgare* (Savi) Ten.], *C. undulatum* (Nutt.) Spreng. var. *undulatum*, *Grindelia squarrosa* (Pursh) Dunal, *Haplopappus* sp., *Monardella* sp., *Solidago* sp., "tall cone flower".

Seasonal Records.—May 31 to October 12 (most commonly July through September).

Specimens examined.—203 ♀, 1 ♂ (BERLIN, BOULDER, CORVALLIS, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, LOS ANGELES, PHILADELPHIA, NEW YORK, RIVERSIDE, SAN FRANCISCO, TUCSON, URBANA, WASHINGTON D.C., ZILLAH).

TRIEPEOLUS PECTORALIS (ROBERTSON)

(Figs. 294–297)

Epeolus pectoralis Robertson 1897: 345 [Lectotype Illinois Natural History Survey No. 15626; ♀, Carlinville, Macoupin Co., Illinois; September 18 1893]; Webb 1980: 109 [lectotype designation (by W. E. LaBerge)].

Triepeolus pectoralis; Robertson 1901: 231; Mitchell 1962: 478–479, Fig. 112 [redescription, illustration of scutellum, axillae].

Epeolus virginiensis Cockerell 1907d: 137 [Holotype: U. S. National Museum of Natural History No. 40107; ♂, Falls Church, Virginia; September 7]; Mitchell 1962: 478 [synonymy].

Triepeolus virginiensis; Brumley 1965: 73.

Epeolus oswegoensis Mitchell 1962: 453 [Holotype: U. S. National Museum of Natural History No. 75202; ♂, Oswego, New York; August 26 1936]. **new synonymy**

Description.—Length ca. 8–11 mm; ITW 1.8–2.1 mm. Integument black/dark brown, with red on part of mandible, sometimes with orange on labrum, apical margin of clypeus, basally on antenna, tegula, and legs (at least in part); dorsal aspect with bands of setae pale yellow (setae, especially banding of metasoma, denser in specimens from Utah and Idaho). Clypeus with strong midline and weak larger punctures; with sparse (females) or dense (males) white, medially directed setae. Mesepisternum with long, erect, simple setae; females dorsally with dense, white, branched setae on upper fourth, sparser on hypoepimeron, ventral three-fourths with punctation small and sparse (separated by up to 5–10 puncture diameters in most specimens), integument especially shining; males with entire mesepisternum densely covered with white, branched

setae, obscuring integument. Paramedian bands distinct (most females and some males), or contiguous with lateral setae (females from southwest and some males). Scutellum moderately bigibbous; axillar spines triangular, reaching midpoint of scutellum. T1 wide rectangular to ovate; T2 with lateral bands acute to weakly acute, mostly on lateral surface of T2. Female: Pseudopygidial area subovate to subquadrate, with relatively long, distinct basal crescent of silvery setae; S5 slightly downcurved; S2–4 with white setae mostly on apicolateral margins (sometimes on entire apical margins). Male: Pygidial plate of moderate size or relatively narrow, with distinct basal transverse ridge; S4–5 with brown apical fringes (sometimes tinged with white on S4); S2–3 with white apical bands of appressed setae.

Comments.—This species is similar to *T. brittaini* in that the mesepisternum has erect, simple setae, but in females of *T. pectoralis* the mesepisternum is much less densely punctate (and therefore is more distinctly shining), the scutum has paramedian bands present, and the pseudopygidial area has a distinct basal crescent of shining setae. Males of *T. pectoralis* and *T. brittaini* may be separated by the clypeal midline, which is stronger in *T. pectoralis*, and the leg coloration, which is partially orange in *T. pectoralis*.

Distribution.—CANADA: New Brunswick; USA: Arizona, Arkansas, Colorado, Connecticut, Delaware, Georgia, Idaho, Illinois, Indiana, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North

Carolina, North Dakota, Ohio, Pennsylvania, South Dakota, Utah, Vermont, Virginia, Washington D.C., Wisconsin.

Host Records.—*Melissodes* (*Eumelissodes*) *rustica* (Say) [= *Melissodes druriella* (Kirby)] (Mitchell 1962: 479, at nesting site; Hurd et al. 1980, evidence not given). According to John S. Ascher (in lit., 2004), this species is common in Ithaca, NY, on *Melissodes druriella*; at this location, both bees commonly go to *Solidago* flowers.

Floral Records.—*Aster ericoides* [= *Symphyotrichum ericoides* (L.) Nesom var. *ericoides*], *Aster pilosus* [= *Symphyotrichum pilosum* (Willd.) Nesom var. *pilosum*], *Bidens bipinnata* L., *Chrysopsis mariana* (L.) Ell., *Erigeron* sp., *Eupatorium coelestinum* [= *Conoclinium coelestinum* (L.) DC.], *Grindelia squarrosa* (Pursh) Dunal, *Heterotheca* sp., *Myosotis* sp., *Solidago canadensis* L., *S. graminifolia* [= *Euthamia graminifolia* (L.) Nutt. var. *graminifolia*], "blue aster".

Seasonal Records.—May 3 (specimens from Washington State) or August 1 to November 11.

Specimens examined.—163 ♀, 123 ♂ (AUSTIN, BOULDER, CORVALLIS, DAVIS, GAINESVILLE, ITHACA, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, PHILADELPHIA, RIVERSIDE, SAN FRANCISCO, STARKVILLE, URBANA, WASHINGTON D.C.).

TRIEPEOLUS PENICILLIFERUS (BRUES)

(Figs. 298–301, 468)

Epeolus penicilliferus Brues 1903: 81–82 [♀ ♂, Austin (Travis Co.), Fedor (Lee Co.), Texas] [Type lost?].

Triepeolus perelegans Cockerell 1921: 8 [Holotype: American Museum of Natural History No. 25089; ♂, Comobabi Mountains (road from Haynes Well to Combabi, Pima Co.), Arizona; 32˚ (1)'N 111˚ (42)'W; 9about 3400 ft); August (9) 1916]. **new synonymy**

Triepeolus trichopygus Cockerell & Timberlake 1929: 169 [Holotype: American Museum of Natural History; ♀, Riverside, California; July 25 1927; *Senecio douglasii*]. **new synonymy**

Description.—Length ca. 9–14.5 mm; ITW 1.8–2.5 mm. Integument black to brown, with red or orange on base of mandible, entire labrum, and legs (excluding basal coxae and spine), usually on part or all of clypeus, entire scape, pedicel, and F1, pronotal lobe, and tegula, sometimes on mesepisternum and venter of meso- and metasomata; dorsally with bands of setae pale yellow. Clypeus shining, lacking or with very weak midline, with distinct large punctures and minute, weakly impressed punctures. Mesepisternum lacking erect, simple setae; upper third (including hypoepimeron) covered with dense, pale yellow, branched setae (females), or with pale, branched setae also on ventral margin, sometimes medially with diffuse, pale, branched setae (males); ventrally mostly asetose with relatively small, weakly impressed punctures, separated by up to 2 puncture diameters. Paramedian bands distinct (females and some males) or joined laterally to pale setae on anterior margin of scutum (most males); scutum

shining. Scutellum weakly bigibbous, slightly flattened and extended posteriorly; axillar spines triangular, not or barely reaching scutellum midpoint. T1 interspace widely rectangular to quadrate; T2 with lateral, longitudinal band of pale setae forming weakly acute to acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area similar to that of *T. concavus*; T5 with narrow band white setae on apical margin lateral to pseudopygidial area; S5 strongly downcurved. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and downturned apical plate; S4–5 with apical fringes white, brown, or (most commonly) white laterally and brown medially; S2–3 with white apical bands setae, (S2 with white seta surpassing apical margin).

Comments.—Although the holotype of this species is apparently lost, the identity of *T. penicilliferus* is clear from the original description. *Triepeolus penicilliferus* is extremely similar to *T. subnitens*, but can be separated from that species by the pseudopygidial area, which does not resemble the pseudopygidial area of *T. concavus* in the latter species, and by the female S5, which is strongly downcurved in *T. penicilliferus* but only very slightly downcurved in *T. subnitens*. Although the distributions of the two species overlap, *T. penicilliferus* appears to be most abundant in Texas, while *T. subnitens* appears to be most abundant in California. Males of the two species are difficult to differentiate, but may be separated based on the following characters: the pronotal lobe tends to be red in *T. penicilliferus* and brown in *T. subnitens*; the clypeus in profile tends to be flatter in *T. penicilliferus* than in *T. subnitens*; the mesepisternum tends to be less

densely punctate and less setose in *T. penicilliferus* than in *T. subnitens*; the pygidial plate is narrower, with a more distinct transverse basal ridge in *T. penicilliferus* than in *T. subnitens*. Although I was unable to locate the type of *T. penicilliferus*, the original description leaves no doubt as to the identity of this species.

Distribution.—MEXICO: Chihuahua, Coahuila, Durango, Sonora, Tamaulipas; USA: Arizona, California, Colorado, Kansas, Missouri, New Mexico, Oklahoma, Texas.

Host Records.—*Svastra* (*Epimelissodes*) *sabinensis sabinensis* (Cockerell) (Rozen, 1983, adult entering nest).

Floral Records.—*Bahia absinthifolia* var. *dealbata* (Gray) Gray, *Bebbia juncea* (Benth.) Greene, *Coreopsis* sp., *Eriogonum deflexum* Torr., *Gaillardia suavis* (Gray & Engelm.) Britt. & Rusby, *Gutierrezia sarothrae* (Pursh) Britt. & Rusby, *Helenium microcephalum* DC., *Heterotheca subaxillaris* (Lam.) Britt. & Rusby, *Larrea tridentata* (Sessé & Moc. ex DC.) Coville, *Nepeta cataria* L., *Opuntia* sp., *Psilostrophe cooperi* (Gray) Greene, *Ratibida columnifera* (Nutt.) Woot. & Standl., *Senecio douglasii* [= *Senecio flaccidus* Less. var. *douglasii* (DC.) B.L. Turner & T.M. Barkl.], *Silphium asperrimum* (= *Silphium radula* Nutt.), *Sphaeralcea* sp., *Verbena halei* Small, *Verbesina helianthoides* Michx., *Viguiera stenoloba* Blake.

Seasonal Records.—April 12 to October 16.

Specimens examined.—104 ♀, 69 ♂ (AUSTIN, BOULDER, CORVALLIS, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, LOS ANGELES, MEXICO CITY, NEW YORK, RIVERSIDE, SAN FRANCISCO, STARKVILLE, TEMPE, WASHINGTON D.C.).

TRIEPEOLUS QUADRIFASCIATUS QUADRIFASCIATUS (SAY)

(Figs. 45, 53, 88, 119, 170, 174, 302, 303)

Epeolus 4 fasciatus[5] Say 1823: 81 [♀; Arcansa (Arkansas)] [Type lost].

Triepeolus quadrifasciatus; Mitchell 1962: 485.

Description.—Length ca. 13–16mm; ITW 2.4–3.1 mm. Integument black, with red on basal half of mandible, labrum, clypeus, interantennal region, scape, pedicel, T1, pronotal lobe, tegula, and legs distal to coxae, (sometimes including coxae; spurs black), often on scutum, axilla, and scutellum; dorsally with bands of setae yellow to pale yellow. Clypeus integument shining, asetose to sparsely covered with golden setae, lacking midline, with distinct or vague larger punctures. Mesepisternum lacking erect, simple setae; dorsally third covered with yellow, branched setae, except sometimes in females with area between hypoepimeron and pronotal lobe at level of scrobal groove lacking yellow setae, sometimes in males with yellow setae extending further ventrally; ventrally asetose or with brown, branched setae, with small punctures separated by up to a puncture diameter (usually less); integument between raised, slightly tuberculate.

[5] Hurd (1979: 2095) cites this species as "*Epeolus 4-fasciatus*;" however, the original description of this species does not include a hyphen in the specific epithet.

Pronotal collar in dorsal view elongate, especially medially (ca. 2 or more OD in length). Scutum shining with paramedian bands distinct and narrow, or absent. Scutellum somewhat flattened and extended posteriorly; axillar spine pointed, surpassing scutellum midpoint (or very rarely only reaching midpoint), curving slightly inwards apically. T1 almost entirely covered with yellow setae except for black longitudinal line medially and sometimes small black oval or diamond medially; T2 with lateral, longitudinal band of pale setae absent, or rarely reduced, forming 90 degree angle with apical, transverse band of pale setae. Female: Pseudopygidial area subquadrate, uniformly covered with darkly shining, coarse setae; S5 slightly downcurved apically; metasomal venter brown, sometimes with small lateral patches white setae on S2–3 (sometimes vaguely on S4). Male: Pygidial plate relatively wide; dark brown apical fringes on S4–5, contrasting with white apical setae laterally or on entire apical margin of S2–3.

Comments.—Although the type specimen of this species is no longer available for study, the meaning is clear from the original description and well understood by most workers making determinations in the collections that I have examined.

This subspecies differs from *T. q. atlanticus* by the entirely red clypeus and interantennal area, which strongly contrast with the black lateral areas of the face; in addition the following areas are often reddish: the axillae, scutellum, and sometimes scutum and mesepisternum. The T1 interspace tends to be a longitudinal line, sometimes with a small medial ovate or diamond area.

However, *T. q. atlanticus* often has the T1 interspace with a small medial ovate area, or even rarely is represented by a longitudinal line only. Although the type of *T. quadrifasciatus* is no longer available for study, the original description leaves no doubt as to the identity of this species.

Distribution.—USA: [Arkansas-original description];Kansas, Louisiana, Oklahoma, Texas.

Floral Records.—*Gaillardia pulchella* Foug., *Helenium tenuifolium* [= *Helenium amarum* (Raf.) H. Rock var. *amarum*], *Helianthus petiolaris* Nutt., *Liatris* sp., *Nama ovata* (= *Hydrolea ovata* Nutt. ex Choisy), *Prionopsis ciliata* [= *Grindelia papposa* Nesom & Suh], *Rudbeckia hirta* L., cotton (= *Gossypium* sp.).

Seasonal Records.—May 31 to October 12.

Specimens examined.—22 ♀, 11 ♂ (AUSTIN, CORVALLIS, ITHACA, LAWRENCE, LOS ANGELES, NEW YORK, SAN FRANCISCO, STARKVILLE, URBANA, WASHINGTON D.C.).

TRIEPEOLUS REMIGATUS (FABRICIUS)

(Figs. 304–306, 484)

Melecta remigata Fabricius 1804: 387 [Carolina] [Type lost? (See comments, below)].

Epeolus remigatus; Lepeletier de Saint-Fargeau 1825: 104.

Epeolus superbus Provancher 1895: 190–191 [Holotype: Université Laval, Collection Provancher; ♀, (Los Angeles, California); 1734 (See comments, below)]. **new synonymy**

Triepeolus remigatus; Robertson 1901: 231; Mitchell 1962: 480–481, Fig. 112 [redescription, illustration of scutellum, axillae]; Rozen 1966: 17–19, Fig. 24 [description, illustration of

predefecating larva]; Bohart 1966: 255–261, Figs. 1–20 [descriptions, photographs and illustrations of egg, first through fourth instar, prepupa, adult].

Epeolus texanus var. *nigripes* Cockerell 1898: 61 [Holotype: U. S. National Museum of Natural History No. 18966; ♂, Mesilla (Dona Ana Co.), New Mexico; August 14; *Helianthus ciliaris*]. **new synonymy**

Triepeolus texanus nigripes; Cockerell 1916b: 392.

Description.—Length ca. 10.5–15.5 mm; ITW 2.4–3.5 mm. Integument black, with red on basal half of mandible, often with orange on labrum, apical margin of clypeus, basal antenna, and legs in southwestern specimens; dorsal aspect with bands of setae yellow. Face sometimes slightly elongate. Clypeus black, with midline absent or rarely weak; larger punctures weak; mostly asetose (some females), basally covered with white setae (some females and some males), or entirely covered with white or brown setae (some males). Mesepisternum lacking erect, simple setae, with distinct dorsal region of dense, yellow, branched setae (lacking on hypoepimeron) and ventral region of black, branched setae, integument beneath with small punctures nearly contiguous to separated by 0.5 puncture diameter. Paramedian bands joining laterally with yellow setae on apical margin of scutum to form strong anchor pattern (both sexes). Scutellum strongly to moderately bigibbous; axillar spines reaching midpoint or, more commonly, surpassing midpoint, with slightly incurved apical point (apex sometimes reddish). T1 interspace ovate to subtriangular, sometimes small; T2 with lateral bands forming 90 degree angle with apical setae or forming

semicircular, basal black region. Female: Pseudopygidial area subovate to subquadrate, setae almost uniformly glossy, fine, and dark, but slightly denser and finer basally; S5 not downcurved or very slightly downturned apically; ventral metasoma lacking pale setae (eastern and midwestern distributions) or S2–4 with bands of pale setae on apicolateral margins (western distribution). Male: Pygidial plate of moderate size, with distinct basal transverse ridge; S4–5 with dark brown apical fringes of setae; S2–3 with apicolateral bands of pale setae (S3 medially also with dark brown setae, which slightly extends past apical margin; S4 also with white setae on apicolateral margin in specimens from western distribution).

Comments.—According to Zimsen (1964), the holotype of this species and *Epeolus mercatus* Fabricius should be located in the Bosc collection in the Museum of Natural History in Paris; however, the specimens are not present (Claire Villemont, in lit., 2005). However, the original description mentions an important feature for identifying *T. remigatus*, namely the distinctly trilobed (i.e., anchor-shaped) black region on the scutum, and this species is consistently understood by workers to mean the one described herein (to judge from numerous previously identified specimens in the collections that I have examined).

According to the original description, the species name *Epeolus superbus* was apparently based on a single female type specimen. The holotype specimen, a female from the same collection locality as indicated in the original description, nonetheless has two lectotype labels on it. To my knowledge neither lectotype

designation has been published. The full label data for the holotype are as follows: "1734 // *Epeolus superbus* Prov. Cal. // Lectotype 442 *Epeolus superbus* (Huart) Provancher Comeau 1944 [red label] // Lectotype *Epeolus superbus* Provancher 1734 Barron '71 [red label]."

Males of this species resemble *T. concavus* and *T. nevadensis* (see comments under those species for distinguishing characters). Females can be distinguished by the anchor-shaped region of black setae on the scutum in combination with the nearly uniform, darkly shining setae of the pseudopygidial area.

Distribution.—MEXICO: Chihuahua; Coahuila, Durango, Jalisco, San Luis Potosí, Sinaloa, Zacatecas; USA: Arizona, California, Colorado, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Maryland, Mississippi, New Jersey, New Mexico, New York, North Carolina, Oklahoma, Pennsylvania, Tennessee, Texas, Virginia, Washington D.C.

Host Records.—*Dieunomia* (*Dieunomia*) *heteropoda* (Say) (2 specimens, at nest entrance, Hidalgo Co., New Mexico); *Centris* sp. (1 specimen with label "Centris Nest #1" from Cochise Co., Arizona), *Peponapis pruinosa* (Say)? (Mitchell, 1962, collection records; John S. Ascher, in lit., 2003, unpublished data), *Xenoglossa strenua* (Cresson) (Mitchell, 1962, collection records; Rozen, 1966, larvae taken from nest; Bohart, 1966, eggs and larvae taken from nests).

Floral Records.—*Bahia absinthifolia* var. *dealbata* (Gray) Gray, *Centaurea repens* [= *Acroptilon repens* (L.) DC.], *Cichorium intybus* L., *Cosmos*

sp., *Eriogonum abertianum neomexicanum* (= *Eriogonum abertianum* Torr.), *E. deflexum* Torr., *Eupatorium linearifolium* (= *Eupatorium glaucescens* Ell.), *Gaillardia pulchella* Foug., *Helianthus annuus* L., *H. ciliaris* DC., *Melilotus alba* [= *Melilotus officinalis* (L.) Lam.], *Petalostemon* sp. (= *Dalea* sp.), *Sphaeralcea fendleri* Gray ssp. *elongata* Kearney, *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray, *Vernonia noveboracensis* (L.) Michx., China aster [= *Callistephus chinensis* (L.) Nees], "cultivated cucurbits".

Seasonal Records.—May 9 to October 22.

Specimens examined.—181 ♀, 45 ♂ (AUSTIN, BOULDER, CHAMELA, CORVALLIS, DAVIS, ITHACA, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, QUÉBEC, RIVERSIDE, SAN FRANCISCO, URBANA, WASHINGTON D.C.).

TRIEPEOLUS ROBUSTUS (CRESSON)

(Figs. 307–309)

Epeolus robustus Cresson 1878: 85–86 [Lectotype: Academy of Natural Sciences No. 2218; ♀, New Mexico]; Cresson 1916: 129 [lectotype designation].

Epeolus nigriceps Smith 1879: 103 [Holotype: The Natural History Museum, London No. 17B.520; ♀, Texas]. **new synonymy**

Triepeolus nigriceps (Smith); Cockerell 1905a: 314.

Triepeolus robustus (Cresson); Cockerell 1906: 304.

Description.—Length ca. 11–18 mm; ITW 2.2–3.6 mm. Integument entirely black to brown; dorsally with bands of setae pale yellow. Clypeus

shining, with distinct larger punctures (females) or densely covered with long, appressed, pale yellow, setae (most males), appearing recessed due to dense, erect, pale yellow and/or brown setae on upper face. Mesepisternum with erect, simple setae; dorsal third, except hypoepimeron, with dense, pale yellow, branched setae (area expanded on males); ventrally with sparse, black to dark brown, branched setae; punctures separated by up to one puncture diameter in some places. Scutum shining, with paramedian bands barely distinct from diffuse, erect and appressed setae on anterior scutum. Scutellum flattened and somewhat extended posteriorly; axillar spines triangular, apex rounded, not reaching midpoint of scutellum. T1 interspace distinctly rectangular, sometimes subtriangular, rarely filled with diffuse, pale yellow setae; T2 with lateral, longitudinal band of pale setae forming 90 degree angle with apical, transverse band of pale setae. Female: Pseudopygidial area delimited by downturned integument, setae relatively long, fine, appressed, and poorly differentiated from rest of setae on T5 (except for white setae apicolaterally on T5); S5 strongly downcurved. Mesosoma and metasoma venter entirely black (occasionally with small patch white setae apicolaterally on S4). Male: Pygidial plate relatively wide, with distinct transverse basal ridge and downturned apical plate; S4–5 with apical fringes (black on S5, black and white to varying degrees on S4); S2–3 with white, apicolateral setae.

Comments.—The *Triepeolus nigriceps* holotype (from Texas) differs from the typical *T. robustus* specimens only in that it has the T1 interspace

partially filled with diffuse pale yellow setae, the T5 lacks pale setae lateral to the pseudopygidial area, and has entirely brown setae on face. There are specimens of *T. robustus* identified by Paul Hurd as a new species, and assigned a manuscript name in honor of Jerome G. Rozen, Jr. This error is likely due to the fact that *T. robustus* appears to have been commonly confused with the new species *Triepeolus* sp. 10; Hurd, who was working on a revision of the genus, likely had not yet seen the lectotype of *T. robustus*, and thus may not have been aware of the mix-up. See comments under *Triepeolus* sp. 10 for characters separating the two species.

Distribution.—MEXICO: Chihuahua, Durango; USA: Arizona, California, Nevada, New Mexico, Texas, Utah.

Floral Records.—*Asclepias subverticillata* (A. Gray) Vail, *Baccharis glutinosa* [= *Baccharis salicifolia* (Ruiz & Pavón) Pers.], *Bahia absinthifolia* var. *dealbata* (Gray) Gray, *Eriogonum deflexum* Torr., *Gaillardia* sp., *Helianthus annuus* L., *Kallstroemia grandiflora* Torr. ex Gray, *Melilotus alba* [= *Melilotus officinalis* (L.) Lam.], *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray.

Seasonal Records.—August 2 to October 16.

Specimens examined.—160 ♀, 90 ♂ (AUSTIN, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, LONDON, LOS ANGELES, MEXICO CITY, NEW YORK, NEW YORK-ASCHER, PHILADELPHIA, RIVERSIDE, SAN FRANCISCO, TEMPE, TUCSON, WASHINGTON D.C.).

TRIEPEOLUS ROHWERI COCKERELL

(Figs. 310, 311)

Triepeolus rohweri Cockerell 1911: 668–669 [Holotype: U. S. National Museum of Natural History No. 100035; ♂, Canadian Zone, North Boulder Creek, Boulder Co. Colorado; August 23 1907].

Description.—Length ca. 10 mm; ITW 2.1–2.4 mm. Integument black, with red on part of mandible, orange on F1 and parts of legs (especially middle and hind legs), brown-orange on tegula; dorsally with bands of setae pale yellow. Clypeus with faint midline and distinct larger punctures, entirely covered with white setae in males. Mesepisternum with long, erect, simple setae; dorsal half covered with pale yellow, branched setae (sparser on hypoepimeron); ventrally with sparse, brown, branched setae, with punctures nearly contiguous to separated by almost 1 puncture diameter, with integument between punctures raised, tuberculate (females), or mesepisternum entirely covered with pale yellow, branched setae (sparser on hypoepimeron; males). Paramedian bands laterally contiguous with diffuse, pale setae on anterior of scutum. Scutellum moderately bigibbous; axillar spines triangular, nearly reaching midpoint of scutellum. T1 interspace widely ovate, with basal and apical transverse bands of pale setae nearly parallel and only separated by little more than 1 OD ; T2 with lateral, longitudinal band of pale setae forming 90 degree angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular to subtriangular, with setae of similar texture throughout, but with setae on basal third shining

silvery and remaining apical setae shining gold; S5 straight in profile. Male: Pygidial plate keyhole shaped, rather long and narrow, with distinguishable transverse basal ridge; S4–5 with apical fringes of setae brown with white laterally; S2–3 with white apical bands of setae.

Comments.—The pseudopygidial area of this species is similar to that of *Triepeolus* sp. 80; however, the two species differ in that only *T. rohweri* has erect, simple setae on the mesepisternum. The pseudopygidial area is also similar to that of *Triepeolus* sp. 81, but these are distinguishable by the angle formed by the lateral longitudinal and apical transverse bands of pale setae on the T2 (forming an acute angle in *Triepeolus* sp. 81, forming a 90 degree angle in *T. rohweri*)

Distribution.—USA: Colorado, Boulder Co.

Seasonal Records.—August 18 to August 23.

Specimens examined.—1 ♀, 1 ♂ (BOULDER, WASHINGTON D.C.).

TRIEPEOLUS RUFITHORAX GRAENICHER

(Figs. 312, 314, 461)

Triepeolus rufithorax Graenicher 1928: 279–281 [Holotype: U. S. National Museum of Natural History No. 41793; ♀, Miami (Miami-Dade Co.), Florida July 16 1927]; Rozen 1966: 4, Fig. 1 [position of egg within host cell]; Mitchell 1962: 481, 482, Fig. 112 [redescription, illustration of scutellum, axillae].

Triepeolus alachuensis Mitchell 1962: 462 [Holotype: Florida State Collection of Arthropods; ♀, Alachua Co., Florida; May 12 1959; *Melilotus alba*]. **new synonymy**

Description.—Length ca. 10.5–14 mm; ITW 2.0–3.1 mm. Integument black or brown, with the following entirely or partly red: mandible, labrum, clypeus, interantennal area (sometimes), basal or entire antennae, dorsal surface of mesosoma, and often parts of metasomal terga; in addition, integument orange on legs. Clypeus with strong midline and faint larger punctures (sometimes covered by white, medially-directed setae, especially in males). Mesepisternum lacking erect, simple setae or with short, sparse, suberect, simple setae; with dense, white and/or black, branched setae on upper third (absent on hypoepimeron), mostly asetose especially ventrally (sparsely setose in males); irregularly punctate (punctures almost contiguous to separated by two puncture diameters). Paramedian bands distinct and narrow or absent, sometimes with dark integumental coloration where the paramedian bands would normally be found. Scutellum moderately bigibbous; axillar spines triangular with pointed apex, reaching or surpassing scutellar midpoint. Wings entirely dusky. T1 interspace variable, variously appearing subquadrate, rectangular, or triangular, sometimes with basal transverse bands of pale setae reduced or entirely absent; T2 with lateral setae absent or reduced, forming weakly acute angle with apical transverse bands of pale setae. (Metasomal tergal bands sometimes very narrow.) Female: Pseudopygidial area subovate to subquadrate, with distinct basal crescent extending laterally to apical margin and partially surrounding medial area of coarse setae; S5 slightly downcurved apically; S3–4 (sometimes also S2) with

pale banding apicolaterally. Male: Pygidial plate of moderate size, keyhole shaped with distinct basal transverse ridge; S4–5 with apical fringes brown; S2–3 with white apical setae, somewhat extended medially on S3.

Comments.—Blacker individuals of this species might be confused with *T. lunatus*, because of the similar shape of the T1 interspace and the pseudopygidial area; see comments under that species.

The *T. alachuensis* holotype has red integumental coloration restricted apically and laterally on the clypeus, the axillar spines, and anterolaterally on the scutum; orange coloration on the antennae basal to the base of F2, the tegula, the pronotal lobes, and the legs; the T1 interspace is subquadrate, and the metasomal banding is narrow. It arguably might have also been synonymized under *T. lunatus*, but I have placed it here due to the similar type localities of *T. alachuensis* and *T. rufithorax*.

Distribution.—USA: Alabama, Florida, Georgia.

Host Records.—*Svastra* sp. (2 specimens "from burrow," in Everglades National Park, Florida); *Svastra* (*Epimelissodes*) *obliqua obliqua* (Say) (Rozen, 1964, adults entering nest, egg found in cell).

Floral Records.—*Bidens pilosa L.*, *Borrichia frutescens* (L.) DC., *Lythrum lineare* L.

Seasonal Records.—March 13 to September 7.

Specimens examined.—97 ♀, 38 ♂ (ANN ARBOR, BOULDER, GAINESVILLE, ITHACA, LAWRENCE, LOS ANGELES, NEW YORK, SAN FRANCISCO, URBANA, WASHINGTON D.C.).

TRIEPEOLUS RUFOCLYPEUS (FOX)

(Figs. 315, 316)

Epeolus rufoclypeus Fox 1891: 344 [Holotype: Academy of Natural Sciences No. 10122; ♀, Kingston, Jamaica; (April)].

Triepeolus foxii Cockerell 1919a: 179 [Holotype: U. S. National Museum of Natural History No. 20711; ♀, Portland, Jamaica]. **new synonymy**

Triepeolus rufoclypeus; Brumley 1965: 73.

Triepeolus foxi; Raw 1984: 503 [lapsus calami].

Description.—Length ca. 8.5–13.5 mm; ITW 1.9–2.3 mm. Integument black to reddish brown, with red on basal mandible, entire or outer margins of labrum, apical margin of clypeus, scape, pedicel, F1, pronotal lobe, tegula, and entire or parts of legs (excluding basal coxae but only sometimes excluding spurs); dorsally with bands of setae pale yellow. Clypeus lacking or with weak midline dorsally, lacking or with faint larger punctures, sometimes covered with diffuse, pale, medially-directed setae (denser in males). Pronotal collar in dorsal view with pale setae usually of the same length, rarely thinner submedially in some males. Mesepisternum lacking erect, simple setae; dorsally with dense, white, branched setae beneath scrobal groove and pronotal lobe; ventral

integument shining, with irregular punctures, nearly contiguous to separated by almost a puncture diameter in some areas, sometimes sparsely covered with pale, branched setae (especially in males). Paramedian bands distinct, truncate or reaching anterior margin of scutum, tapering anteriorly. Scutellum weakly bigibbous; axillar spines triangular, reaching or slightly surpassing scutellum midpoint. T1 interspace triangular; with <-shaped band of pale setae mostly on lateral margin, but with apical, transverse band of pale setae present (sometimes reduced, but less reduced than that of *T. cameroni*); T2 with lateral, longitudinal band of pale setae absent or reduced, forming weakly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area subquadrate, longitudinally elongate, with nearly uniformly golden setae (basal third with shorter, slightly more shining setae); S5 straight in profile. Male: Pygidial plate keyhole shaped, with weak transverse basal ridge and apical downturned plate; metasomal sternal setae uniformly golden; S3–5 with well-developed apical fringes of setae.

Comments.—This species strongly resembles *T. cameroni* and may represent a northern variety of that species; see comments under *T. cameroni* for further discussion.

Distribution.—MEXICO: Nuevo León, Sinaloa, Tamaulipas; USA: Texas; JAMAICA: Portland; GRENADA: St. George's.

Floral Records.—*Asclepias* sp., *Cevallia sinuata* Lag., *Gaillardia suavis* (Gray & Engelm.) Britt. & Rusby, *Hedyotis nigricans* [= *Stenaria nigricans*

(Lam.) Terrell var. *nigricans*], *Helenium microcephalum* DC., *Nepeta cataria* L., *Palafoxia texana* DC., *Phacelia laxa* Small, *Phyla nodiflora* (L.) Greene, *Prosopis glandulosa* Torr., *Ratibida columnifera* (Nutt.) Woot. & Standl., *Rudbeckia bicolor* (= *Rudbeckia hirta* L. var. *pulcherrima* Farw.), *Sapindus drummondii* [= *Sapindus saponaria* L. var. *drummondii* (Hook. & Arn.) L. Benson], *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray, squash (= *Cucurbita*).

Seasonal Records.—April (day unspecified) to October 28.

Specimens examined.—110 ♀, 165 ♂ (BERKELEY, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, PHILADELPHIA, STARKVILLE, URBANA, WASHINGTON D.C.).

TRIEPEOLUS RUGOSUS MITCHELL

(Figs. 317–319)

Triepeolus rugosus Mitchell 1962: 482–483, Fig. 112 [Holotype: Florida State Collection of Arthropods; ♀, Highlands Hammock State Park (Highlands Co.), Florida; March 31 1956].

Description.—Length ca. 8.5–10 mm; ITW 2.0–2.6 mm. Integument black; dorsal aspect with bands of setae pale grey/white. Clypeus elongate, lacking midline and larger punctures; covered with diffuse white setae. Mesepisternum with dense, erect, simple setae; punctures deeply impressed and generally separated by ca. 1 puncture diameter, with integument between raised,

almost tuberculate; with branched, white setae on dorsal third. Paramedian bands distinct, narrow, reaching anterior margin of scutum and curving slightly outwards anteriorly. Scutum and scutellum shining. Scutellum moderately bigibbous (holotype scutellum somewhat extended posteriorly); axillar spines triangular, reaching or almost reaching midpoint of scutellum. T1 interspace widely ovate to rectangular, apical transverse band of pale setae interrupted medially, but T2 and distal terga with transverse bands of pale setae continuous (notched slightly on T2); T2 with lateral setae forming weakly acute angle with apical band of setae (mostly on lateral surface of T2). Female: Pseudopygidial area subquadrate to subovate, with basal region of silvery reflectance strongly differentiated from relatively long, coarse setae on rest of disk; S5 not downcurved; metasoma with diffuse white setae on all sterna, denser apically on S2–4 Male: Unknown.

Comments.—This species is distinguishable from the other species with pale grey to white banding by the elongate face and erect, simple setae on mesepisternum, and from *T. donatus* by the rugose mesepisternum. The male of *T. rugosus* is currently unknown; the mesepisternum may not be as distinctly rugose in the males as in the females of this species. Thus, it may be that the males of *T. rugosus* and *T. donatus* cannot be separated based on the rugosity of the mesepisternum, given that the mesepisternum is sexually dimorphic in at least one other species of *Triepeolus* (i.e., *T. pectoralis*, in which the female

mesepisternum is very sparsely punctate and the male is much more densely punctate and setose).

Distribution.—USA: Florida, New Jersey.

Floral Records.—*Pontederia* sp.

Seasonal Records.—March 3 to July 9.

Specimens examined.—7 ♀ (GAINESVILLE, LAWRENCE, LOS ANGELES, RALEIGH, WASHINGTON D.C.).

TRIEPEOLUS SCELESTUS (CRESSON)

(Figs. 320, 321)

Epeolus scelestus Cresson 1878: 86–87 [Lectotype: Academy of Natural Sciences No. 2221; ♀, Texas]; Cresson 1916: 130 [lectotype designation].

Triepeolus scelestus (Cresson); Brumley 1965: 73.

Description.—Length ca. 10–12 mm; ITW 1.8–2.4 mm. Integument black, with red to orange on part of mandible and F1, sometimes on parts of legs; dorsally with bands of setae yellow to pale yellow. Clypeus with faint midline and larger punctures. Mesepisternum lacking erect, simple setae; with dense, pale yellow, branched setae between hypoepimeron and pronotal lobe; ventrally most asetose, with dense, somewhat irregular punctures (separated by up to 1.5 puncture diameters in some areas), integument raised between punctures. Paramedian bands distinct. Scutellum weakly bigibbous; axillar spines triangular, reaching scutellum midpoint, apically directed slightly inward. T1 interspace

subquadrate to rectangular; T2 with lateral, longitudinal band of pale setae absent, rarely much reduced, apparently forming 90 degree angle with apical transverse band of pale setae; T1–2 with apical transverse bands of setae interrupted medially, posterior terga with apical transverse bands uninterrupted. Female: Pseudopygidial area ovate, with setae uniformly coarse, darkly shining golden brown, poorly reflective and poorly differentiated from setae of rest of T5 except for rather diffuse white setae apicolaterally on T5; S5 faintly downcurved apically. Male: Unknown.

Comments.—This species is very similar to *Triepeolus* sp. 43; see comments under that species for distinguishing characters.

Distribution.—USA: Kansas, Texas.

Floral Records.—*Helianthus annuus* L.

Seasonal Records.—June 10 to September 30.

Specimens examined.—17 ♀ (CORVALLIS, LAWRENCE, LOGAN, NEW YORK, PHILADELPHIA, SAN FRANCISCO).

TRIEPEOLUS SUBALPINUS COCKERELL

(Figs. 322, 323)

Triepeolus subalpinus Cockerell 1910b: 245 [Holotype: U. S. National Museum of Natural History No. 100037; ♀, Eldora (Boulder Co.), Colorado; August 18–19; *Grindelia* (*subalpina*)].

Triepeolus lestes Cockerell 1921: 11 [Holotype: American Museum of Natural History No. 25093; ♀, Glenwood Springs (Garfield Co.), Colorado; about 39 33'N 107 20'W; 5800 ft; July 22–29 1919]. **new synonymy**

Triepeolus stricklandi Cockerell 1937: 86–87 [Holotype: Canadian National Collection No. 4172; ♀, Lethbridge, Alberta, Canada; August 5 1935]. **new synonymy**

Description.—Length ca. 7–11 mm; ITW 1.4–2.3 mm. Integument black, with red on part of mandible, sometimes with orange on F1 and parts of legs (especially in specimens from southern localities); dorsally with bands of setae pale yellow. Clypeus lacking midline or with faint midline present dorsally, with faint large punctures, sometimes covered with diffuse white setae (females) or covered with dense, white, medially-directed setae (males). Mesepisternum with long, erect, simple setae; dorsal half covered with pale, branched setae (sparser or absent on hypoepimeron); ventrally with punctation small and dense, separated by up to a puncture width in some spots, with integument between punctures elevated, tuberculate (females) or covered with dense, white, branched setae, mostly obscuring dense, rough punctures on entire mesepisternum (males). Paramedian bands distinct or laterally contiguous with pale yellow setae on anterior margin of scutum. Scutellum weakly bigibbous, somewhat extended posteriorly and sloping ventrally; axillar spine triangular (sometimes with apex rounded), not or barely reaching midpoint of scutellum. T1 interspace widely rectangular to ovate; T2 with lateral, longitudinal band of pale setae forming 90 degree angle with apical, transverse band of pale setae. Female: Pseudopygidial

area small, triangular, with uniformly silvery setae; S5 straight in profile. Mesosoma and metasoma venter black (S2–3 with diffuse pale yellow apical bands in specimens from southern localities). Male: Pygidial plate keyhole shaped, with rather weakly defined apical downturned plate and basal transverse ridge; S4-5 with brown apical fringes of setae; S2-3 with apical bands of white setae.

Comments.—This species is extremely similar to. *T. brittaini*; see comments under that species for differentiating characters. *Triepeolus subalpinus* is also very similar to the *Triepeolus paenepectoralis* complex of species in overall appearance, due to the presence of long, erect setae on the mesepisternum, the rectangular T1 interspace, and the 90 degree angle formed by the transverse and longitudinal bands of pale setae on T2 in these species. However, females of *T. subalpinus* are easily differentiated by their small, triangular, silvery pseudopygidial area.

Distribution.—CANADA: Alberta, Saskatchewan; USA: Arizona, California, Colorado, Idaho, Kansas, Montana, New Mexico, North Dakota, Utah, Wyoming.

Host Records.—*Melissodes* (*Eumelissodes*) *agilis* Cresson? (Hurd et al. 1980: adults collected on same flowers).

Floral Records.—*Chrysopsis villosa* [= *Heterotheca villosa* (Pursh) Shinners var. *villosa*], *Chrysothamnus* sp., *Epilobium brachycarpum* K. Presl,

Grindelia squarrosa (Pursh) Dunal, *Helianthus petiolaris* Nutt., *Heterotheca subaxillaris* (Lam.) Britt. & Rusby.

Seasonal Records.—June 16 to October 10.

Specimens examined.—103 ♀, 2 ♂ (BOULDER, DAVIS, LAWRENCE, LOGAN, NEW YORK, OTTAWA, RIVERSIDE, SAN FRANCISCO, URBANA, WASHINGTON D.C.).

TRIEPEOLUS SUBLUNATUS COCKERELL

(Figs. 324, 325)

Triepeolus sublunatus Cockerell 1907c: 62–63 [Holotype: U. S. National Museum of Natural History No. 23289; ♂, Dripping Spring (Organ Mountains, Dona Ana Co., New Mexico); August 10].

Description.—Length ca. 10–12.5 mm; ITW 2.0–2.4 mm. Integument black, with red on mandible, orange on labrum, apical clypeus, scape, pedicel, F1, tegula, and part or entire legs (excluding basal coxae and spurs), sometimes on pronotal lobe; dorsally with bands of setae pale yellow. Clypeus with elevated midline, lacking larger punctures, covered with relatively sparse, long, white setae. Mesepisternum lacking erect, simple setae; dorsal half with dense, pale yellow, branched setae (sparser on hypoepimeron), with small patch brown, branched setae between pronotal lobe and hypoepimeron; also with pale yellow, branched setae on anterior and ventral surfaces of mesepisternum; ventral half of lateral surface of mesepisternum with sparse, brown, branched setae, with dense,

rough punctures (separated by up to 1 puncture diameter in a few spots), with integument between punctures raised and shining, tuberculate. Paramedian bands distinct, tapering at anterior margin. Scutellum moderately bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 wide subovate to triangular; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae; metasomal terga with pattern of yellow bands of setae resembling that of *T. verbesinae*. Female: Pseudopygidial area subquadrate, with fine, uniformly brown setae, apical margin faintly emarginate; S5 straight in profile. Male: Pygidial plate relatively long, lacking distinct transverse basal ridge and apical downturned plate; S3–5 with apical fringes of setae (brown to golden on S5, golden to white on S4, white on S3; apical fringe slightly less developed on S3); S2 with white apical band of setae.

Comments.—Based on the pattern of yellow bands of setae on the metasoma, this species strongly resembles *T. verbesinae* (an unrelated species belonging to the *T. verbesinae* species group); *T. sublunatus* is easily distinguished from *T. verbesinae* by the larger size and the entirely different pseudopygidial area and S5.

Distribution.—USA: Arizona, New Mexico.

Seasonal Records.—August 10 to September 11.

Specimens examined.—6 ♀, 4 ♂ (DAVIS, NEW YORK, RIVERSIDE, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS SUBNITENS COCKERELL & TIMBERLAKE

(Figs. 326, 327, 462)

Triepeolus subnitens Cockerell & Timberlake 1929: 167–169 [Holotype: U. S. National Museum of Natural History No. 54849; ♀, Riverside, California; *Helianthus annuus*].

Description.—Length ca. 11–15 mm; ITW 2.2–2.9 mm. Integument black, with red on base of mandible, part or entire labrum, scape, pedicel, T1, and legs (excluding base of coxae and spurs); often on part or entire clypeus; rarely on pronotal lobe, tegula, scutum, and mesepisternum (possibly due to preservation?); dorsally with bands of setae pale yellow. Clypeus shining, lacking or with very weak midline, with distinct large punctures and minute, weakly impressed punctures (sometimes covered by appressed, white setae in males). Mesepisternum lacking erect, simple setae; dorsal half (including hypoepimeron) with dense, pale yellow, branched setae, ventrally with very short, sparse, brown, branched setae; punctures fine and not very deeply impressed, separated by up to one puncture diameter (but some nearly contiguous; denser in males) (females and some males), or entirely covered with pale, branched setae (some males). Scutum shining; paramedian bands distinct (most females) or joined laterally with pale setae on anterior margin of scutum (males and some females). Scutellum weakly bigibbous, flattened and extended posteriorly; axillar spines triangular, apically rounded, not reaching midpoint of scutellum. T1 interspace subquadrate; basal transverse band distinctly interrupted medially; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae.

Female: Pseudopygidial area very short and wide, seemingly formed by the downturned integument, setae long and fine; T5 with relatively broad patch white setae lateral to pseudopygidial area; S5 not or faintly downcurved. Metasomal sterna entirely brown or with lateral white setae on S2–3 (especially in southwestern specimens). Male: Pygidial plate relatively wide, keyhole shaped, with transverse basal ridge often hidden beneath dense brown setae and distinct downturned apical plate; S4–5 with brown or brown and white apical fringes; S2–3 with white apical bands setae (S2 white setae extending past apical margin).

Comments.—This species is extremely similar to *T. penicilliferus*; see comments under that species for differentiating characteristics.

Distribution.—MEXICO: Chihuahua, Durango; USA: Arizona, California, Kansas, Nevada, New Mexico, Oklahoma, Texas, Utah.

Host Records.—*Svastra* (*Epimelissodes*) *obliqua* (Say) (Hurd et al. 1980, adult entering burrow).

Floral Records.—*Centaurea melitensis* L., *Coreopsis lanceolata* L., *Grindelia squarrosa* (Pursh) Dunal, *Gutierrezia sarothrae* (Pursh) Britt. & Rusby, *Helianthus annuus* L., *Hymenothrix wislizeni* Gray, *Melilotus alba* [= *Melilotus officinalis* (L.) Lam.], *Senecio douglasii* [= *Senecio flaccidus* Less. var. *douglasii* (DC.) B.L. Turner & T.M. Barkl.], *Verbena* sp., *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray.

Seasonal Records.—May 4 to October 12.

Specimens examined.—112 ♀, 5 ♂ (ANN ARBOR, AUSTIN, CORVALLIS, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, LOS ANGELES, MEXICO CITY, NEW YORK, SAN FRANCISCO, STARKVILLE, TEMPE, TUCSON, WASHINGTON D.C.).

TRIEPEOLUS TANNERI COCKERELL

(Figs. 328, 329)

Triepeolus tanneri Cockerell 1928b: 232–233 [Holotype: U. S. National Museum of Natural History No. 100038; ♂, Farr West (Weber Co.), Utah].

Description.—Length ca. 11.5–15 mm; ITW 2.4–3.0 mm. Integument black, with red on part of mandible and outer F1; dorsally with bands of setae pale yellow. Clypeus lacking or with faint dorsal midline, with faint larger punctures on field of very fine and dense punctures. Mesepisternum lacking erect, simple setae, with small patch of pale yellow, branched setae posterior to pronotal lobe, otherwise mostly asetose, with very fine, nearly contiguous punctures, grading ventrally to slightly larger, more widely-spaced punctures (punctures separated by up to almost one puncture diameter in some places). Paramedian bands reaching anterior margin of scutum, distinct or nearly contiguous laterally with pale setae on anterior margin of scutum. Scutellum strongly bigibbous; axillar spines triangular, reaching midpoint of scutellum, apical point slightly incurved. T1 interspace ovate to quadrate; T2 with lateral, longitudinal band of pale setae reduced or forming obtuse acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area very distinctive, long and narrow with basal patch

of fine, slightly lighter reflecting setae, with median elevated U-shaped ridge, and apical circular patch of coarse setae; T5 entirely black; S5 tapered anteriorly and slightly downcurved. Mesosoma and metasoma venter entirely black/brown. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and apical downturned plate; S4–5 with black apical fringes of setae; rest of ventral metasoma with black setae (S3 apical setae very slightly surpassing apical margin).

Comments.—Females of this species are readily distinguished by the unique pseudopygidial area.

Distribution.—USA: Colorado, Kansas, Utah.

Floral Records.—*Helianthus salicifolius* A. Dietr., *Solidago* sp.

Seasonal Records.—July 26 to October 19.

Specimens examined.—9 ♀, 2 ♂ (LAWRENCE, LOGAN, URBANA, WASHINGTON D.C.).

TRIEPEOLUS TEPANECUS (CRESSON) **new combination**

(Figs. 330–332)

Epeolus tepanecus Cresson 1878: 88 [Lectotype: Academy of Natural Sciences No. 2239; ♂, Mexico]; Cresson 1916: 131 [lectotype designation].

Description.—Length ca. 10–13 mm; ITW 2.0–2.7 mm. Integument black, with reddish brown apically on mandible and outer F1; dorsally with relatively narrow bands of setae yellow. Clypeus with strong midline and faint

larger punctures (densely covered with white, medially directed setae in males); upper face lacking dense patches of erect setae. Mesepisternum lacking erect, simple setae; integument shining, with small, finely impressed punctures separated by one to two puncture diameters; dorsally with white, branched setae (females), or with setae somewhat diffuse, and extending anteriorly and ventrally (males). Scutum shining; paramedian bands distinct and narrow. Scutellum weakly to moderately bigibbous, sloping ventrally; axillar spines triangular, usually reaching scutellum midpoint, apex strongly pointed and somewhat incurved. T1 with pale bands of setae mostly on lateral and apical margins, forming V-shape at margin of wide, triangular-shaped interspace; apical transverse band of pale setae widely interrupted medially; T2 with lateral, longitudinal band of pale setae absent. Female: Pseudopygidial area semicircular to subquadrate, mostly composed of long, fine, golden-reflecting setae (poorly differentiated from basal setae on T5); S5 straight in profile; S2–4 with diffuse, pale setae apically. Male: Pygidial plate keyhole shaped, with distinct basal transverse ridge and apical downturned plate; S4–5 with dark brown apical fringes of setae (sometimes with white laterally on S4), contrasting with white apical bands on S2–3 (S3 with white setae slightly surpassing apical margin).

Comments.—This species is very similar to *T. laticeps* and *Triepeolus* sp. 110; all three species share the darkly shining pseudopygidial area, with a poorly differentiated basal region of finer, denser setae, and the sparse, short, erect, simple setae of the mesepisternum. See Table 5 for further characteristics of each

species. This species also resembles *T. totonacus*; see comments under that species for differentiating characters.

Distribution.—MEXICO: Chiapas, Colima, Jalisco, Michoacán, Nayarit.

Seasonal Records.—July 4 to December 10.

Specimens examined.—12 ♀, 3 ♂ (CHAMELA, LAWRENCE, LOGAN, NEW YORK, PHILADELPHIA, SAN FRANCISCO).

TRIEPEOLUS TEXANUS (CRESSON)

(Figs. 333, 334)

Epeolus texanus Cresson 1878: 87 [Lectotype: Academy of Natural Sciences No. 2223; ♂, Texas]; Cresson 1916: 132 [lectotype designation].

Triepeolus wyomingensis Cockerell 1905c: 201–202 [Holotype: U. S. National Museum of Natural History No. 100040; ♂, Wyoming]. **new synonymy**

Triepeolus eldredi Cockerell 1907a: 52 [Holotype: U. S. National Museum of Natural History No. 100029; ♂, N. Yakima, Washington; August 7 1903]. **new synonymy**

Triepeolus helianthi grandior Cockerell 1919b: 300 [Holotype: U. S. National Museum of Natural History No. 100030; ♂, Florissant (Teller Co.), Colorado; July 29 1902; *Carduus* (=*Cirsium*) *acaulescens*]. **new synonymy**

Triepeolus rectangularis Cockerell 1921: 9–10 [Holotype: American Museum of Natural History No. 25091; ♀, Huntsville (near Ogden, Weber Co.), Utah; about 41˚ 17'N 110˚ 46'W; July 26 1920]. **new synonymy**

Triepeolus dichropus Cockerell 1921: 11 [Holotype: American Museum of Natural History No. 25094; ♂, Glenwood Springs (Garfield Co.), Colorado; about 39˚ 33'N 107˚ 20'W; 5800 ft; July (29) 1919]. **new synonymy**

Triepeolus pallidiventris Cockerell & Sandhouse 1924: 308 [Holotype: California Academy of Sciences No. 1600; ♂, Vivian Park (Provo Canyon, Utah Co.), Utah; July 7 1922]. **new synonymy**

Triepeolus texanus texanus; Hurd 1979: 2096.

Triepeolus nr. *eldredi*; Clement 1984: 300–303, Figs. 1–4 [Biological data].

Description.—Length ca. 10–13 mm; ITW 2.2–2.5 mm. Integument black, with red on part of mandible and F1, sometimes on parts of legs (especially specimens from more southern localities); dorsally with bands of setae pale yellow. Clypeus with apical margin surpassing lower tangent of compound eyes by ca. 2 OD, with midline and distinct larger punctures, mostly asetose (females) or covered with dense, long, pale setae (males). Mesepisternum with erect, simple setae, dorsally with pale, branched setae on most of upper half except sparser on hypoepimeron, or between hypoepimeron and pronotal lobe (rarely restricted to narrow area near pronotal lobe and scant area near scrobal groove); ventral integument shining, with punctures small and dense (nearly contiguous to separated by 1 puncture diameter in certain areas), with sparse, short, brown, branched setae (females); or entire mesepisternum covered with dense, pale yellow, branched setae (males). Paramedian bands distinct, rarely nearly absent (some females), or joined to diffuse setae on anterior margin of scutum (some females, males). Scutellum weakly to moderately bigibbous, slightly extended posteriorly; axillar spines triangular, not or barely reaching midpoint of scutellum. T1 interspace rectangular to subovate (lacking basal transverse band of pale setae

in two females from Idaho and Washington); T2 with lateral, longitudinal band of pale setae reduced or forming 90 degree angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular to subquadrate, with distinct basal shining crescent; S5 very slightly downcurved apically. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and apical downturned plate; S4–5 with brown apical fringes (sometimes with white setae laterally, especially on S4); S2–3 with apical bands of white setae (S3 white setae slightly surpassing apical margin).

Comments.—*Triepeolus texanus* is similar in appearance to *T. paenepectoralis*, but can be distinguished from that species by the clypeus, which is elongate and has a relatively strong midline in *T. texanus*. *Triepeolus texanus* is also similar in appearance to *T. donatus*; see comments under the latter species for distinguishing features.

The integument of this species is predominantly black in the northwestern localities, while specimens from Arizona, Texas, Colorado, and Utah have more areas of red.

Interestingly, this species appears to have been collected only on various species of thistle.

Distribution.—CANADA: British Columbia; USA: Arizona, Colorado, Idaho, Montana, Oregon, Texas, Utah, Washington, Wyoming.

Host Records.—*Melissodes* (*Eumelissodes*) *rustica* (Say) [= *Melissodes druriella* (Kirby)] (Clement, 1973, larvae from nests; Clement, 1984, adults

observed entering nests); *Nomia melanderi* Cockerell (1 specimen from nesting site, Benson Ward, Utah).

Floral Records.—*Cirsium acaulescens* (= *Cirsium scariosum* Nutt.), *C. lanceolatum* [= *Cirsium vulgare* (Savi) Ten.], *C. texanum* Buckl., *C. undulatum* (Nutt.) Spreng. var. *undulatum.*

Seasonal Records.—May 27 to August 20.

Specimens examined.—66 ♀, 2 ♂ (BOULDER, CORVALLIS, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, NEW YORK, PHILADELPHIA, RIVERSIDE, SAN FRANCISCO, URBANA, WASHINGTON D.C.).

TRIEPEOLUS TOTONACUS (CRESSON)

(Figs. 335, 336)

Epeolus totonacus Cresson 1878: 87 [Lectotype: Academy of Natural Sciences No. 2222; ♀, Mexico]; Cresson 1916: 133 [lectotype designation].

Triepeolus totonacus; Cockerell 1905b: 165.

Description.—Length ca. 9.5–11.5 mm; ITW 2.1–2.5 mm. Integument black, with red on part of mandible, orange on F1; dorsally with bands of setae yellow-orange. Clypeus with faint to strong midline and larger punctures. Mesepisternum lacking erect, simple setae; with small patches of dense, white, branched setae below scrobal groove and posterior to pronotal lobe; punctation relatively small, nearly contiguous to separated by 1 to 2 puncture diameters (up to 3 in some specimens); integument between punctures shining, relatively flat.

Paramedian bands distinct. Scutellum weakly to moderately bigibbous; axillar spine triangular, reaching scutellum midpoint. T1 interspace widely ovate to subquadrate, apical and basal transverse bands of yellow setae interrupted medially; T2 with lateral, longitudinal band of yellow setae absent or mostly on lateral surface of T2, forming weakly acute angle with apical, transverse band of yellow setae. Female: Pseudopygidial area subquadrate, basal half to third covered with fine, shining setae, remaining apical region with coarse, darker setae; S5 straight in profile or very slightly downcurved apically. Male: Unknown.

Comments.—This species resembles other species belonging to the *T. tepanecus* species group (Table 5), but can be differentiated from them by the pseudopygidial area, which has a distinctly differentiated, and relatively long, basal region of fine, shining setae, and by the mesepisternum, which entirely lacks erect, simple setae. It can also be differentiated from some of those species by the T1 interspace, which is widely ovate to subquadrate (never triangular). A specimen of this species was identified as "PCAM 26" by D. Yanega.

Distribution.—MEXICO: Chiapas, Jalisco, Michoacán, Oaxaca, Puebla.

Seasonal Records.—July 21 to December 5 (Majority of specimens collected in October and November).

Specimens examined.—13 ♀ (BERKELEY, CHAMELA, LAWRENCE, LOGAN, SAN FRANCISCO).

TRIEPEOLUS TOWNSENDI COCKERELL

(Figs. 337, 338)

Triepeolus townsendi Cockerell 1907c: 63–64 [Holotype: U. S. National Museum of Natural History No. 100039; ♂, Rio Ruidoso, White Mountains (Lincoln Co.), New Mexico; July 27; about 6700 ft; *Erigeron macranthus*].

Triepeolus concinnus Cockerell 1917b: 300–301 [Holotype: U. S. National Museum of Natural History No. 22894; ♀, Meadow Valley (= Río Piedras Verdes, 9 km S. Colonia García, Chihuahua, according to Labougle, 1990: 50), Mexico]. **new synonymy**

Description.—Length ca. 8–11 mm; ITW 1.7–2.5 mm. Integument black, with dark reddish brown to orange on apical mandible and usually on outer F1, sometimes on labrum and apical clypeus, orange usually on at least part of legs (excluding coxae and spurs, often brown on at least front and middle trochanters and front femur), brownish orange on tegula; dorsally with bands of setae yellow. Clypeus with distinct midline and faint larger punctures, covered with white setae in males. Mesepisternum apparently lacking or with short, sparse, erect, simple setae, with pale yellow, branched setae on dorsal half and ventral margins of mesepisternum, enclosing circular region of brown, branched setae (smaller brown area in specimens from New Mexico), punctures small, nearly contiguous to separated by 0.5 OD, with integument between raised (females), or entire mesepisternum covered with dense, white, branched setae (males). Paramedian bands distinct (both sexes). Scutellum moderately to weakly bigibbous; axillar spines triangular, reaching midpoint of scutellum. T1 interspace subquadrate to

subovate; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular to subquadrate, with distinct, silvery basal crescent; S5 straight in profile. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and apical downturned plate; S4–5 with golden apical fringes of setae; S2–3 with apical bands of white setae.

Comments.—This specimen is similar to *T. laticaudus*, but can be separated from that species by the punctation of the mesepisternum (denser in *T. townsendi*), and by the relative differentiation of the basal shining setae on the pseudopygidial area (less differentiated in *T. townsendi*). *Triepeolus townsendi* is also similar to *T. medusa*; see comments under that species for differentiating characters.

Distribution.—MEXICO: Chihuahua, Hidalgo; USA: Arizona, Colorado, New Mexico, Texas, Utah.

Floral Records.—*Apocynum* sp., *Cirsium* sp., *Cryptantha* sp. *Grindelia* sp., *Erigeron speciosus* (Lindl.) DC. var. *macranthus* (Nutt.) Cronq., *Heliopsis helianthoides* (L.) Sweet var. *scabra* (Dunal) Fern., *Ratibida columnifera* (Nutt.) Woot. & Standl., *Senecio* sp., *Vicia pulchella* Kunth.

Seasonal Records.—July 19 to September 10.

Specimens examined.—61 ♀, 1 ♂ (BOULDER, DAVIS, CORVALLIS, GAINESVILLE, LAWRENCE, LOGAN, NEW YORK, RIVERSIDE, SAN FRANCISCO, TEMPE, WASHINGTON D.C.).

TRIEPEOLUS TRISTIS (SMITH)

(Figs. 85, 112, 138, 165, 339, 340, 485)

Epeolus luctuosus Eversmann 1852: 101–102 [nec Spinola] [Syntype series: Zoological Institute, the Russian Academy of Sciences; Casan (= Kazan) and Orenburg, Russia (see comments, below)]; Arnold 1885: 286-287, Figs. 1, 2 [redescription]. (not seen)

Epeolus tristis Smith 1854: 258 [replacement name].

Epeolus speciosus Gerstaecker 1869: 158–159 [Holotype: Zoologisches Museum, Humboldt-Universität; ♂, Deutschland Arnswalde (Pomerania) (= Choszczno, West Pomeranian Voivodship, Poland]; Bischoff 1930: 2 [synonymy].

Triepeolus tristis; Bischoff 1930: 1–2.

Epeolus (*Triepeolus*) *tristis*; Warncke 1982:120.

Description.—Length ca. 7.5–11 mm; ITW 1.9–2.5 mm. Integument black, with red on part of mandible, orange on F1; dorsally with bands of setae white. Clypeus lacking midline and larger punctures, usually covered with diffuse white setae. Mesepisternum with sparse, short, suberect, simple setae ventrally; dorsal half densely covered with white, branched setae (sparser on hypoepimeron); ventrally with sparser, black, branched setae; punctures nearly contiguous to separated by 1 puncture diameter, integument between punctures raised, tuberculate in appearance. Paramedian bands usually laterally contiguous with diffuse white setae on anterior fourth to third of scutum, rarely distinct in some females. Scutellum strongly to moderately bigibbous; axillar spines elongated into pointed spine, apically slightly incurved, reaching posterior margin

of scutellum. T1 interspace widely ovate; T2 with lateral, longitudinal band of white setae forming 90 degree angle with apical, transverse band of white setae; all metasomal terga with apical transverse bands of white setae interrupted medially. Female: Pseudopygidial area quadrate, poorly differentiated from basal setae of T5, but with median apical setae slightly elongate, silvery; S5 straight in profile. Male: Pygidial plate keyhole shaped, with distinct apical downturned plate, but somewhat indistinct basal transverse ridge; S3–5 with rather short apical fringes of setae brown or brown intermixed with white.

Comments.—This is the only known species of *Triepeolus* in Europe. The following notes were supplied by Y. Pesenko (in lit., 2005), regarding the syntypes of *Epeolus luctuosus* in the Zoological Institute, Russian Academy of Sciences: "*Epeolus luctuosus* Eversmann, 1852: 101 (nec Spinola, 1851) was described from an unknown number of males and females 'Hab. in provinciis Casanensi et Orenburgensi'. In that time, both provinces, Kazan and Orenburg, occupied a much larger territory than at the present, covering nearly all the southeast of European Russia, southern Urals, and western Kazakhstan (named "Kirgis" at that time). The lectotype of the species was not designated. In the collection of our institute, there are three syntypes of the species: 1 male labeled "Kas." [Kazan], "*luctuosus*" (both by Eversmann's hand); 1 male labeled "Kirgis"; 1 female labeled "Spassk" [at present, Pugaschev in Saratov province]. I have examined these syntypes, they really belong to *E. tristis* in the current understanding."

Distribution.—AUSTRIA: Burgenland, Tirol; ITALY: Trentino-South Tyrol; POLAND: West Pomerania; RUSSIA: Bashkir ASSR (= Bashkortostan), Tatarstan, Saratov; SLOVAKIA: Trebišov; SLOVENIA: Nitra.

Host Records.—*Tetralonia* (*Tetralonia*) *malvae* Rossi? (Bischoff, 1930, no supporting evidence given); *Tetraloniella* (*Tetraloniella*) *macroglossa* Illiger (= *Tetralonia* (*Tetralonia*) *malvae* Rossi) (Westrich, 1989, no supporting evidence given); *Tetraloniella* (*Tetraloniella*) *nana* Morawitz (Gogala, 1999, no supporting evidence given).

Floral Records.—*Centaurea axillaris* Willd.

Seasonal Records.—July 15 to August 8.

Specimens examined.—19 ♀, 10 ♂ (LAWRENCE, LAWRENCE-BAKER; WASHINGTON D.C.).

TRIEPEOLUS VENTRALIS (MEADE-WALDO)

(Figs. 7, 86, 113, 341, 342)

Epeolus ventralis Meade-Waldo 1913: 96–97 [Holotype: The Natural History Museum, London 17B.502; ♂, Hsikou, near Tientsin (= Tianjin), China; June 17 1906]; Yasumatsu 1933: 1, Figs. e, f, h, Plate 1 [distribution within Japan, illustrations of female S6, male pygidial plate, and dorsal habitus]; Yasumatsu 1938: 223 [placed within *Triepeolus*-group].

Epeolus tsushimensis (Cockerell); Bischoff 1930: 2–3 (probable misidentification).

Triepeolus ventralis (Meade-Waldo); Maeta et al. 1987: 26 [egg index]; Rightmyer 2004b: 256–262, Figs. 19–41 [redescription, photographs of male holotype, illustrations of male and female].

Triepeolus signatus Hedicke 1940: 345–347 [♀; Kintschou (= Jinzhou), Liauhsi (= Liaoning) Province, China; July]. (not seen) **new synonymy**

Description.—Length ca. 8–13 mm; ITW 2.0–2.9 mm. Integument black, with red on part of mandible, brownish orange on F1; dorsally with bands of setae white. Clypeus with faint midline (often stronger dorsally), with distinguishable larger punctures, often covered with sparse (females) or dense (males) white setae. Mesepisternum with sparse, short, suberect, simple setae ventrally; dorsal half covered with white, branched setae (sparser on hypoepimeron), venter with sparser brown, branched setae (females), or entirely covered with dense, white, branched setae (males); punctures nearly contiguous to separated by a puncture diameter in a few spots; integument between punctures raised, tuberculate. Paramedian bands distinct or barely contiguous with sparse anterior setae (females) or surrounded by diffuse anterior setae (males). Scutellum moderately bigibbous; axillar spines triangular, reaching midpoint of scutellum. T1 interspace widely ovate, apical transverse band of white setae widely interrupted medially, basal transverse band of white setae not or barely interrupted; T2 with lateral, longitudinal band of white setae absent. Female: Pseudopygidial area quadrate, poorly differentiated from basal setae of T5, but with median apical setae slightly elongate, silvery; S5 straight in profile. Male: Pygidial plate keyhole shaped, with strongly differentiated apical downturned plate and basal transverse ridge; S3–5 with apical fringes of setae rather short, white (S3) grading to brown (S5).

Comments.—This is the only known species of *Triepeolus* in Asia. Although I have not seen the holotype of *T. signatus*, based on the original description and type locality, the name is almost certainly a junior synonym of *T. ventralis*.

Distribution.—CHINA: Liaoning, Tianjin, [and, according to Wu Ran-yu, in lit., 2001, Guangxi, Zhejiang]; JAPAN: Chūbu, Kyūshū, Shikoku; RUSSIA: Jewish Autonomous Oblast, Khabarovsk Krai, Primorsky Krai (or Maritime Province).

Host Records.—*Tetraloniella* (*Tetraloniella*) *mitsukurii* Cockerell (Maeta et al., 1996, reared from host cell)].

Seasonal Records.—June 17 to October 9.

Specimens examined.—52♀, 37 ♂ (ANSFELDEN, FUKUOKA, LAWRENCE, LAWRENCE-BAKER, LONDON, TORONTO, WASHINGTON D.C.).

TRIEPEOLUS VICINUS (CRESSON)

(Figs. 9, 91, 127, 343, 345)

Epeolus vicinus Cresson 1865: 185 [Lectotype: Academy of Natural Sciences No. 2217; ♂, Cuba]; Cresson 1916: 133 [lectotype designation].

Triepeolus vicinus; Cockerell 1919a: 179; Genaro 1999: 216, Figs. 1d, 2a, 3b [redescription, illustrations of dorsal habitus, pseudopygidial area, male S7–8].

Description.—Length ca. 8–11 mm; ITW 2.0–2.5 mm. Integument black, with red sometimes on pronotal lobe and apical tip of axillar spine, red to orange

on basal mandible, labrum and clypeus, orange on scape, pedicel, F1, tegula, and legs (excluding basal coxae); dorsally with bands of setae yellow-orange. Clypeus with elevated midline and faint larger punctures (obscured by rough, smaller punctation on clypeus). Mesepisternum lacking erect, simple setae; with dense, yellow, branched setae on margins, enclosing circular medial region of black, shorter, branched setae. Paramedian bands distinct, relatively long. Scutellum strongly bigibbous; axillar spines pointed, reaching posterior margin of scutellum, apical point incurved. T1 interspace widely ovate, rectangular, or subquadrate, medially widened due to medial interruption of apical and basal transverse bands of yellow setae; T2 with lateral, longitudinal band of yellow setae mostly on lateral surface of T2, forming weakly acute angle with apical, transverse band of yellow setae; all metasomal tergal bands (except T6 of male) with apical transverse bands medially interrupted. Female: Pseudopygidial area subquadrate, with fairly uniform, coarse, golden setae, basally with vague crescent of finer setae; S5 straight in profile. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and apical downturned plate; S4–5 with brown, to brown with white basally, apical fringes of setae; S2–3 with apical bands of white setae.

Distribution.—CUBA: Havana, Guantánamo (Sagua Baracoa), Pinar del Rio (Viñales).

Seasonal Records.—October (day unspecified).

Specimens examined.—3 ♀, 2 ♂ (ITHACA, LAWRENCE, PHILADELPHIA).

TRIEPEOLUS VICTORI GENARO

(Figs. 346, 347)

Triepeolus victori Genaro 1998: 92–94, Figs. 1–3 [Holotype: Florida State Collection of Arthropods; ♀, near Filipinas Larimar Mine, Prov. Barahona, Dominican Republic; June 26– July 7 1992].

Description.—Length ca. 15–17 mm; ITW 3.3–3.6 mm. Integument black, with orange to red on mandible, labrum, clypeus, scape, pedicel, F1, pronotal lobe, tegula, and legs (excluding basal coxae), often on interantennal area, axillar spine, venter of metasoma, and posterior of T5; dorsally with bands of setae yellow-orange. Clypeus with weak midline and larger punctures, sometimes covered with pale setae (especially in males). Mesepisternum with erect, simple setae; with yellow, branched setae on margins, surrounding median circular region of black, branched setae, punctures small, nearly contiguous. Paramedian bands relatively long and wide, curving slightly outward at anterior margin (nearly contiguous with pale setae on anterior margin of scutum in males). Scutellum strongly bigibbous; axillar spines well surpassing midpoint of scutellum, sharply pointed, with apical point directed inward. T1 lacking basal transverse band of pale setae, with wide apical transverse band of yellow setae nearly continuous (medially interrupted by minute, longitudinal black line), forming black basal semicircular region; T2 with lateral, longitudinal band of pale setae absent. Female: Pseudopygidial area ovate, poorly differentiated from rest

of T5, composed of fine, golden setae; S5 straight in profile. Male: Pygidial plate rectangular, with transverse basal ridge and apical downturned plate; S4–5 with golden apical fringes of setae; S2–3 with apical bands of pale yellow setae (S3 pale setae slightly surpassing apical margin).

Comments.—*Triepeolus victori* is one of two robust species of *Triepeolus* in the Caribbean, the other one being *T. wilsoni*. The two species can be differentiated by the pattern of yellow bands on the metasoma, which are conspicuously medially interrupted in *T. wilsoni* and nearly or completely contiguous in *T. victori*. In addition, the T1 of *T. victori* lacks a basal transverse band of yellow setae, while this band is present in *T. wilsoni*.

Distribution.—DOMINICAN REPUBLIC: Barahona, El Seibo.

Seasonal Records.—June 26 to July 7.

Specimens examined.—2 ♀, 2 ♂ (GAINESVILLE, LOS ANGELES, NEW YORK).

TRIEPEOLUS WILSONI (CRESSON)

(Figs. 348, 349)

Epeolus wilsoni Cresson 1865: 183–184 [Lectotype: Academy of Natural Sciences No. 2216; ♂, Cuba]; Cresson 1916: 134 [lectotype designation].

Triepeolus wilsoni; Cockerell 1919a: 179–180; Genaro 1998: Figs. 1b, 2a, b [illustrations of dorsal habitus, male S7–8]; Genaro 1999: 216, Figs. 1a, 3a [redescription, illustrations of dorsal habitus, male S7–8].

Triepeolus buscki Cockerell 1919a: 179–180 [Holotype: U. S. National Museum of Natural History No. 20712; ♀, Baracoa (Guantánamo Prov.), Cuba; August 1902]; Genaro 1999: 216 [synonymy].

Description.—Length ca. 15–16 mm; ITW 3.13.3 mm. Integument black to reddish brown, with orange on labrum, clypeus, interantennal area, frons near compound eye, entire antenna or basal to F2, and parts of legs (especially distal to femora); dorsally with bands of setae yellow-orange. Clypeus with midline on dorsal half and vague larger punctures (covered with pale setae in males). Mesepisternum with erect, simple setae; with yellow, branched setae at margins surrounding darker circular area of short, brown, branched setae (pale setae absent on hypoepimeron), punctures dense, with integument between raised, somewhat tuberculate. Paramedian bands distinct, curving outward at anterior margin (nearly contiguous with yellow setae on anterior margin of scutum in males). Scutellum strongly bigibbous; axillar spines well surpassing midpoint of scutellum, very sharply pointed, curving inward at apical point. T1 interspace widely ovate to triangular; apical and basal transverse bands interrupted medially; T2 with lateral, longitudinal band of pale setae absent; metasomal terga posterior of T1 with apical transverse bands widely interrupted medially. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and apical downturned plate; S4–5 with golden apical fringes of setae, contrasting with white apical bands of setae on S2–3 (slightly surpassing apical margin on S3).

Comments.—This species is similar to *T. victori*; see comments under that species for differentiating characters.

Distribution.—CUBA: Pinar del Rio, San Vicente.

Seasonal Records.—June (day unspecified) to July 7.

Specimens examined.—1 ♀, 2 ♂ (ITHACA, LAWRENCE, PHILADELPHIA, WASHINGTON D.C.).

TRIEPEOLUS ZACATECUS (CRESSON)

(Figs. 350, 351)

Epeolus zacatecus Cresson 1878: 85 [Lectotype: Academy of Natural Sciences 2240; ♀, Mexico]; Cresson 1916: 134 [lectotype designation].

Description.—Length ca. 14–17 mm; ITW 3.2–3.5 mm ITW, rarely as small as 11 mm in length, 2.3 mm. Integument black, with reddish orange on outer F1; dorsally with bands of setae yellow-orange to yellow (paler in males). Clypeus with elevated midline and faint larger punctures (females) or densely covered with white setae (males). Mesepisternum with sparse, erect, simple setae; dorsal half covered with dense, pale yellow, branched setae, ventrally with sparser, black, branched setae (females) or densely covered with white, branched setae (males); punctures small, deeply impressed so that integument between appears tuberculate, separated by up to 1 puncture diameter. Paramedian bands wide, but distinct (most females) or laterally contiguous with yellow setae on anterior scutum (some females, males). Scutellum strongly to moderately

bigibbous, axillar spines surpassing midpoint of scutellum, sharply-pointed, anterior point curving inward; inner margin outlined with white setae. T1 interspace ovate, triangular, or subquadrate; T2 with lateral, longitudinal band of pale setae forming 90 degree angle with apical, transverse band of pale setae, or enlarged to form semicircular basal area of dark brown setae. Female: Pseudopygidial area ovate, formed of nearly uniformly long, darkly shining setae; S5 straight in profile. Male: Pygidial plate relatively wide, with distinct transverse basal ridge (sometimes covered by dark setae) and apical downturned plate; S3–5 with apical fringes of setae, brown to pale golden on S4–5, white and sometimes reduced on S3.

Comments.—This species is very similar to *T. grandis*; see comments under that species for differentiating characters. This species is superficially similar to *T. kathrynae*, due to the very long axillar spines, the yellow coloration, and the robust body form; however females can easily be separated by the entirely different pseudopygidial areas. This species was identified as "PCAM 34" by T. Griswold.

Distribution.—COSTA RICA: Guanacaste; MEXICO: Chiapas, Colima, Jalisco, Michoacán, Oaxaca, San Luis Potosí, Sinaloa, Sonora, Tamaulipas, Veracruz.

Floral Records.—*Croton* sp.

Seasonal Records.—June 7 to December 7.

Specimens examined.—42 ♀, 7 ♂ (BERKELEY, CHAMELA, DAVIS, GAINESVILLE, HEREDIA, LAWRENCE, LOGAN, NEW YORK, PHILADELPHIA, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS SP. 2

(Figs. 352, 353)

Description.—Length ca. 10.5–13.5 mm; ITW 2.2–2.6 mm. Integument black, with red on basal mandible, labrum, apical clypeus, scape, pedicel, F1, pronotal lobe, tegula, and legs (excluding basal coxae and spurs), often on axillar spine; dorsally with bands of setae pale yellow. Clypeus relatively flat in profile, with faint midline and larger punctures, sometimes covered with sparse, pale setae. Mesepisternum lacking erect, simple setae, dorsal half covered with dense, pale yellow, branched setae (sparser or absent on hypoepimeron); ventral integument shining, with punctures relatively small, separated by up to 1–2 puncture widths. Paramedian bands slightly curving outward anteriorly, connected with yellow lateral setae on subapical margin of scutum, forming anchor shape. Scutellum moderately bigibbous; axillar spine triangular, reaching or exceeding scutellar midpoint, apical point directed inward, often with reddish coloration. T1 interspace triangular, subquadrate, or ovate; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area triangular, with faint inverted V-shaped region of silvery reflectance basally, and with paler-reflecting setae on

apical margin (these setae slightly upturned); S5 straight in profile. Male: Unknown.

Comments.—This species resembles *Triepeolus* sp. 74; see comments under that species for differentiating characters.

Distribution.—USA: Arizona, Kansas, New Mexico, Texas.

Seasonal Records.—May 1 to September 15.

Specimens examined.—18 ♀ (CORVALLIS, DAVIS, LAWRENCE, LOS ANGELES, NEW YORK).

TRIEPEOLUS SP. 10

(Figs. 354, 355)

Description.—Length ca. 10–15.5 mm; ITW 2.1–2.8 mm. Integument black to brown, with red medially on mandible; dorsally with bands of setae usually yellow on T1, grading to white posteriorly on terga. Clypeus shining, sometimes with very faint midline, with distinct larger punctures (female) or covered with appressed white setae (male), clypeus very flat, appearing recessed due to erect setae on upper face. Mesepisternum with long, erect, simple setae, with small patch dense, white, appressed, branched setae below scrobal groove and along posterior margin of mesepisternum to top of mesocoxa (female) or more densely covered with appressed, white, branched setae, usually sparser medially to give impression of rounded, asetose or very sparsely, darkly setose, black region (male); punctures very small, generally separated by 2 or 3 puncture

widths (female) or a puncture width or less (male), integument shining. Scutum shining; paramedian bands absent or interspersed with diffuse white setae on anterior scutum. Scutellum very weakly bigibbous, weakly extended posteriorly; axillar spine triangular, rounded apically, not reaching midpoint of scutellum. T1 quadrate, rarely subovate or subtriangular, apical and basal bands interrupted medially (basal interruption continued along anterior surface of T1 forming rectangular dark area); T2 with lateral, longitudinal band of pale setae absent, or mostly on lateral surface of T2, forming very weakly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area similar to that of *T. concavus*, but area generally wider and setae less erect; S5 strongly downcurved, apical margin surpassing apical margin of T5. Male: Pygidial plate relatively wide, with transverse basal ridge often hidden beneath long setae and relatively weak downturned apical plate; S4–5 with white to golden brown apical fringes, S3 with white apical setae surpassing apical margin of sternum, slightly curled apically; S2 with white apical band of setae.

Comments.—This species resembles *T. robustus*, but can be readily differentiated from that species by the coloration of the transverse bands of pale setae on the metasomal terga (grading posteriorly from yellow to white in *Triepeolus* sp. 10, uniformly pale yellow in *T. robustus*), as well as by the general shape of the T1 interspace (strongly rectangular in *T. robustus*) and the lateral, longitudinal setae of T2 (forming a right angle with the apical, transverse band of pale setae in *T. robustus*, usually absent in *Triepeolus* sp. 10). This species also

strongly resembles *Triepeolus* sp. 11, but *Triepeolus* sp. 10 has the paramedian bands indistinct, the upper face has erect setae such that clypeus appears recessed, and the metasomal band coloration is different. In addition, the pseudopygidial area of *Triepeolus* sp. 11 resembles that of *T. concavus*, while the pseudopygidial area of *Triepeolus* sp. 10 does not.

Distribution.—COSTA RICA: Guanacaste, Puntarenas; MEXICO: Chiapas, Jalisco, Michoacán, Nayarit, Oaxaca, Puebla, Veracruz.

Floral Records.—*Eysenhardtia polystachya* [= *Eysenhardtia orthocarpa* (Gray) S. Wats.], *Sida* sp., Asteraceae.

Seasonal Records.—June 16 to December 2.

Specimens examined.—27 ♀, 39 ♂ (BERKELEY, CHAMELA, CORVALLIS, DAVIS, HEREDIA, LAWRENCE, LOGAN, RIVERSIDE, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS SP. 11

(Figs. 356, 357)

Description.—Length ca. 10.5–12 mm; ITW 2.1–2.5 mm. Integument black to brown, with red medially on mandible; dorsally with bands of setae pale yellow. Clypeus with faint to distinct midline, larger punctures faint (female) or covered with appressed white setae (male), clypeus in lateral view slightly convex, mirroring slope of face. Mesepisternum with erect, simple setae (sparser and shorter than that of *Triepeolus* sp. 10), dorsally and along posterior margin

with dense, white, appressed, branched setae (also along anterior surface and ventrally in males); punctures moderately small, in places separated by 2–3 puncture diameter or less (more densely punctate in males). Paramedian bands distinct, relatively narrow. Scutellum very weakly bigibbous, somewhat extended posteriorly; axillar spines triangular, rounded apically, not reaching midpoint of scutellum. T1 wide quadrate, apical and basal bands interrupted medially; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area similar to that of *T. concavus*, but setae less distinctly forming posterior plate, basal setae more erect than that of *Triepeolus* sp. 10; S5 strongly downcurved. Male: Pygidial plate relatively wide, with transverse basal ridge often hidden beneath long setae and downturned apical plate; S4–5 with dark brown apical fringes (sometimes with white laterally), S3 with white apical setae slightly extended beyond apical margin, S2 with white apical band of setae.

Comments.—See comments under *Triepeolus* sp. 10. All of the known specimens of this species were obtained from one collection event (see distributional and seasonal records, below).

Distribution.—MEXICO: Nayarit (29 km N Peñitas).

Seasonal Records.—September 28.

Specimens examined.—13 ♀, 10 ♂ (WASHINGTON D.C.).

TRIEPEOLUS SP. 18

(Figs. 358, 359)

Description.—Length ca. 11 mm; ITW 3.0–3.1 mm. Integument black, with orange on basal mandible, labrum, scape, pedicel, F1, and legs (excluding coxae and spurs), sometimes on apical margin of clypeus, brown on tegula; dorsally with bands of setae yellow. Clypeus slightly elongate, with elevated midline and faint larger punctures, sometimes covered with diffuse white setae. Mesepisternum lacking erect, simple setae; dorsal half with dense, yellow, branched setae, sparser on hypoepimeron, anterior surface with sparse, yellow, branched setae; punctation nearly contiguous to separated by one puncture diameter, integument between flat, matte. Paramedian bands distinct. Scutellum moderately to weakly bigibbous; axillar spines triangular, relatively flat, reaching midpoint of scutellum. T1 interspace triangular to wide ovate; T2 with lateral, longitudinal band of pale setae forming weakly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular, basally with relatively long region of silvery setae, apically with wide region of very coarse, sparse, erect setae; S5 straight in profile. Male: Unknown.

Distribution.—USA: Texas (Val Verde Co, Terrell Co).

Seasonal Records.—September 22 to October 15.

Specimens examined.—3 ♀ (AUSTIN, LOGAN).

TRIEPEOLUS SP. 19

(Figs. 360–362)

Description.—Length ca. 9–10 mm; ITW 2.1–2.2 mm. Integument black, with red on part of mandible, orange on F1, sometimes on tegula and middle and hind legs; dorsally with bands of setae orange-yellow to pale yellow. Clypeus with elevated midline and faint larger punctures laterally, sometimes covered with diffuse white setae. Mesepisternum lacking erect, simple setae, dorsal half with well-defined region of dense, white or pale yellow, branched setae (absent or less dense on hypoepimeron), ventrally with very shining integument, punctures minute, spaced as much as 10 puncture diameters apart in some specimens. Paramedian bands distinct. Scutellum weakly to moderately bigibbous; axillar spines relatively long and pointed, surpassing midpoint of scutellum. T1 interspace ovate to subtriangular or subquadrate; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular to subquadrate, with distinct, narrow, basal silvery crescent; S5 straight in profile. Male: Unknown.

Comments.—This species is distinctive for the particularly shining mesepisternum. Specimens from the more southern locales (i.e., Jalisco and Oaxaca) tend to have orange bands of setae, while those of Sinaloa and Sonora have rather pale yellow bands of setae.

Distribution.—MEXICO: Jalisco, Oaxaca, Sinaloa, Sonora.

Seasonal Records.—June 19 to October 28.

Specimens examined.—9 ♀ (CORVALLIS, DAVIS, LAWRENCE, LOGAN).

TRIEPEOLUS SP. 37

(Figs. 363, 364)

Description.—Length ca. 10 mm; ITW 2.0 mm. Integument black, with orange on basal mandible, labrum, apical clypeus, scape, pedicel, F1, and legs (excluding basal coxae and spurs), pale brown on tegula; dorsally with bands of setae pale yellow. Clypeus with faint midline (stronger dorsally) and larger punctures. Mesepisternum lacking erect, simple setae; with dense, pale yellow, branched setae on all margins, enclosing circular patch of short, brown, branched setae medioventrally, integument with punctures nearly contiguous to separated by 0.5 puncture diameter. Paramedian bands distinct but nearly laterally contiguous with pale setae curving medially towards paramedian bands on anterior of scutum. Scutellum weakly bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace widely ovate, with basal transverse band of pale setae notched medially and apical transverse band of pale setae medially interrupted; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area transversely ovate, covered with fine, brown setae, except apicomedially with tuft of long, golden setae; S5 straight in profile. Male: Unknown.

Distribution.—USA: Texas (Maverick Co., Eagle Pass; Lee Co., Fedor).

Floral Records.—*Dalea lasiathera* Gray.

Seasonal Records.—April 11 to June 1.

Specimens examined.—2 ♀ (BERLIN, LAWRENCE).

TRIEPEOLUS SP. 39

(Figs. 365, 366)

Description.—Length ca. 10–11.5 mm; ITW 2.2–3.0 mm. Integument black to reddish brown, with red on mandible, orange on part or entire labrum, F1 and distal podites or entire legs (excluding basal coxae and spurs), often on apical clypeus, scape, pedicel, and tegula; dorsally with bands of setae yellow to pale yellow. Clypeus with faint midline and larger punctures (sometimes obscured by sparse white setae, denser white setae in males). Mesepisternum lacking erect, simple setae; sparsely to densely covered with pale yellow, branched setae (female) or dorsally with dense, pale yellow, branched setae, ventrally with dark brown, branched setae (male). Paramedian bands often laterally contiguous with diffuse, pale setae on anterior of scutum (especially in males), or distinct. Scutellum weakly bigibbous, posterior surface somewhat extended into posterior ridge; axillar spines triangular, not or barely reaching midpoint of scutellum. T1 interspace very wide, narrow rectangular to ovate, with median circular patch dark setae; T2 with lateral, longitudinal band of pale setae absent or forming very obtuse angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular to subquadrate with very uniform, coppery, long, fine setae; S5 straight in profile. Male: Pygidial plate long and moderately narrow, lacking

distinct transverse basal ridge and apical downturned plate; S4–5 with golden to white apical fringes, S2–3 with white apical setae (S3 with white setae slightly surpassing apical margin).

Comments.—This species resembles *T. californicus* in the shape of the T1 interspace and the uniformly shining pseudopygidial area; however the two species can be separated based on the angle formed by the lateral longitudinal and apical transverse bands of pale setae on the T2 (acute in *T. californicus*, obtuse or absent in *Triepeolus* sp. 39), by the paramedian bands (long and distinct in *T. californicus*, shorter and often connected laterally to diffuse pale setae on anterior margin of the scutum in *Triepeolus* sp. 39), and by the color of the setae on the pseudopygidial area (golden in *T. californicus*, coppery in *Triepeolus* sp. 39). In addition, the flight season of *T. californicus* is in the summer and early fall, while that of *Triepeolus* sp. 39 is in the spring.

Distribution.—USA: Arizona, California, Nevada, Utah.

Floral Records.—*Argemone* sp., *Coreopsis* sp., *Larrea* sp., *Senecio douglasii* [= *Senecio flaccidus* Less. var. *douglasii* (DC.) B.L. Turner & T.M. Barkl.].

Seasonal Records.—April 10 to June 15.

Specimens examined.—24 ♀, 5 ♂ (DAVIS, LAWRENCE, LOGAN, NEW YORK, RIVERSIDE, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS SP. 42

(Figs. 367, 368)

Description.—Length ca. 10–11 mm; ITW 2.0–2.6 mm. Integument black, with red on part of mandible, F1, tegula, and legs (except basal coxae and spurs), sometimes on labrum, pedicel, and scape; dorsally with bands of setae yellow to pale yellow. Clypeus lacking or with weak midline, with distinct large punctures (weak punctures in one specimen from Utah). Mesepisternum with sparse, short, erect, simple setae; dorsal third and anterior surface with dense, pale yellow, branched setae (not, or sparser, on hypoepimeron; reduced and not on anterior surface in one specimen from Nevada); ventrally mostly asetose; punctures dense and small (occasionally separated by 1–2 puncture diameters), integument between raised, tuberculate. Paramedian bands distinct. Scutellum moderately bigibbous; axillar spines triangular, reaching scutellar midpoint. T1 wide ovate or rectangular, apical transverse band of pale setae interrupted medially (uninterrupted in one specimen from Utah); T2 with lateral, longitudinal band of pale setae forming 90 degree angle with apical, transverse band of pale setae (weakly acute in one specimen from Utah); apical transverse band of pale setae medially interrupted. Female: Pseudopygidial area triangular, with rather blunt setae very uniform in density and texture, appearing paler golden on margins; S5 strait along length. Male: Unknown.

Comments.—*Triepeolus* sp. 42 currently consists of two slightly differing forms. One is represented by three females from San Bernardino Co., California,

in which the bands of setae on the metasoma are relatively dense and yellow; the other is represented by three females from Utah and Nevada, in which the bands of setae are paler yellow and more diffuse. It is possible that these differences are due to preservation or age of the specimens when collected, or they may represent different geographic forms of the species. Alternatively, additional material may lend support for segregating the two types as two distinct species. This species resembles *T. denverensis*; see comments under that species for differentiating characters. The specimens from California also closely resemble *Triepeolus* sp. 144 (and, to a lesser degree, *Triepeolus* sp. 78), but may be distinguished from them by the pseudopygidial area, which is comprised of very differently textured setae in those two species, and by the longer axillar spines in *Triepeolus* spp. 144 and 78.

Distribution.—USA: California (San Bernardino), Nevada, Utah.

Seasonal Records.—September 6 to October 30.

Specimens examined.—6 ♀ (DAVIS, LAWRENCE, LOGAN, RIVERSIDE, WASHINGTON D.C.).

TRIEPEOLUS SP. 43

(Figs. 369, 370)

Description.—Length ca. 9–11 mm; ITW 1.9–2.5 mm. Integument entirely black (less commonly), or with red to orange on part of mandible and F1, less commonly also on labrum, apical clypeus, and part of legs, rarely also on

tegula; dorsally with bands of setae yellow to yellow-orange. Clypeus lacking or with very faint midline and larger punctures, sometimes covered with diffuse setae. Mesepisternum lacking erect, simple setae, dorsally with region of white, branched setae variable (on dorsal third excluding hypoepimeron, or limited to regions below scrobal groove and posterior to pronotal lobe); integument shining, punctation small, somewhat weakly impressed, separated by up to one puncture diameter in some places. Paramedian bands distinct, relatively short and sometimes very narrow. Scutellum weakly to moderately bigibbous; axillar spines triangular, not or nearly reaching midpoint of scutellum; posterior margin of scutellum with pale setae restricted to lateral margins. T1 sometimes lacking pale setae at basolateral corner, interspace strongly rectangular to quadrate, sometimes forming plus-shaped sign with medially-interrupted basal and apical transverse bands of pale setae; T2 with lateral, longitudinal band of pale setae absent or forming weakly acute angle with apical, transverse band of pale setae; at least T1–2 (often also T3 and T4) with apical bands medially interrupted. Female: Pseudopygidial area wide-ovate, with nearly uniform, relatively long, fine, golden setae; T5 with distinct patch white setae lateral to pseudopygidial area; S5 faintly downcurved apically; S2–4 with apical transverse bands of white setae**.** Male: Unknown.

Comments.—This species strongly resembles *T. scelestus*, but differs in the following characters: on the female T5, there is a well-differentiated patch of white setae lateral to the pseudopygidial area in *Triepeolus* sp. 43, while in *T.*

scelestus these white setae are typically reduced to the apical margin of the tergum, or fully present but rather diffuse and not so strongly differentiated from the pseudopygidial area; the metanotum is entirely covered with pale yellow setae in *T. scelestus*, while in *Triepeolus* sp. 43 these pale setae are restricted to the lateral margins of the metanotum; the apical transverse bands of yellow setae on the metasoma are medially interrupted on only T1–2 in *T. scelestus*, while in *Triepeolus* sp. 43 these bands are often medially interrupted at least on T1–3; and the venter of the metasoma lacks white setae in *T. scelestus*, while in *Triepeolus* sp. 43 white setae are present on the apical margins of S2–4. This species was identified as "PCAM 28" by D. Yanega.

Distribution.—MEXICO: Guerrero, Michoacán, Morelos, Oaxaca, Puebla.

Floral Records.—*Gymnosperma glutinosum* (Spreng.) Less.

Seasonal Records.—September 6 to January 25.

Specimens examined.—7 ♀ (CORVALLIS, LAWRENCE, LOGAN, PUEBLA).

TRIEPEOLUS SP. 44

(Figs. 371–373)

Description.—Length ca. 7–10 mm; ITW 1.5–2.1 mm. Integument black, with orange on F1 and legs (excluding basal coxae and spurs, and sometimes parts of front leg), often on labrum, part or entire clypeus, scape, pedicel, and tegula; dorsally with bands of setae pale yellow. Clypeus lacking midline, with faint larger punctures. Mesepisternum lacking erect, simple setae; at least dorsal half

with distinct region of pale yellow, branched setae, ventrally with short, black, branched setae or with sparse pale setae; punctation relatively small, dense, irregular, integument between raised and somewhat tuberculate, punctures separated by up to 1.5 puncture diameters. Paramedian bands distinct or contiguous with lateral setae. Scutellum weakly bigibbous; axillar triangular, almost reaching midpoint of scutellum. T1 interspace strongly rectangular, plus-shaped when considered with median interruption of basal and apical bands; T2 with lateral, longitudinal band of pale setae forming obtuse angle with apical, transverse band of pale setae. Female: Pseudopygidial area wide ovate, setae uniformly golden, fine, relatively long, sometimes with vague, small basal region of more silvery-reflecting setae; S5 straight in profile or modestly downcurved apically; amount of white setae on metasomal sterna variable, ranging from at least S4 with small lateral patch white setae (some specimens from AZ) to S2–4 with medially continuous apical bands of white setae. Male: Unknown.

Comments.—This species is somewhat polymorphic, especially in the abundance of pale setae on the mesepisternum and metasomal sterna and the amount that the S5 is apically curved down apically. It is similar to *Triepeolus* sp. 49 in the T1 interspace and overall size, but differs in aspects of the pseudopygidial area, S5, and punctation of the mesepisternum. It is also similar to *Triepeolus* sp. 61; see comments under that species for differentiating characters.

Distribution.—MEXICO: Chihuahua, Durango, Zacatecas; USA: Arizona, New Mexico, Texas.

Floral Records.—*Amphiachyris dracunculoides* (DC.) Nutt., *Baccharis glutinosa* [= *Baccharis salicifolia* (Ruiz & Pavón) Pers.], *Sphaeralcea hastulata* Gray.

Seasonal Records.—August 17 to October 24.

Specimens examined.—27 ♀ (AUSTIN, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, RIVERSIDE, WASHINGTON D.C.).

TRIEPEOLUS SP. 49

(Figs. 374, 375)

Description.—Length ca. 8 mm; ITW 1.6 mm. Integument black, with red on part of mandible and F1; dorsally with bands of setae pale yellow. Clypeus lacking midline and larger punctures. Mesepisternum lacking erect, simple setae, dorsal fourth (excluding hypoepimeron) covered with pale, branched setae, or only small area posterior to pronotal lobe with such setae; ventrally with integument shining, with small punctures relatively evenly spaced ca. 0.5–1 puncture width apart. Paramedian bands distinct. Scutellum weakly bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace strongly rectangular, forming plus-shaped sign with medially interrupted apical and basal transverse bands of pale setae; T2 with lateral, longitudinal band of pale setae absent or nearly so. Female: Pseudopygidial area longitudinally ovate, with

basal area of silvery, pilose setae (these setae not extended apically along lateral margin of pseudopygidial area), apically with relatively long, coarse setae; S5 conspicuously downcurved. Male: Unknown.

Comments.—This species is very similar to *Triepeolus* sp. 44; see comments under that species for differentiating characters. This species was identified as "PCAM 29" by T. Griswold.

Distribution.—MEXICO: Puebla.

Floral Records.—*Viguiera dentata* (Cav.) Spreng.

Seasonal Records.—September 16 to November 3.

Specimens examined.—2 ♀ (LAWRENCE, PUEBLA).

TRIEPEOLUS SP. 51

(Figs. 376, 377)

Description.—Length ca. 7–9 mm; ITW 1.6–2.0 mm. Integument black, with brownish red on mandible and labrum, usually on scutellum, sometimes on apical or entire clypeus, mesepisternum, scutum, and dorsal metasoma, orange on entire antenna, pronotal lobe, tegula, legs, and ventral metasoma; dorsally with bands of setae pale yellow. Clypeus lacking midline, with faint larger punctures, sometimes covered with diffuse white setae (denser in males). Mesepisternum lacking erect, simple setae, dorsally with dense, white, branched setae, grading to sparser setae ventrally, mostly obscuring integument beneath, punctures nearly contiguous to separated by nearly 1 puncture diameter, integument between

punctures raised, tuberculate. Paramedian bands distinct or laterally contiguous with pale setae on anterior of scutum. Scutellum weakly bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace widely ovate (apical and basal transverse bands of pale setae parallel-sided); T2 with lateral, longitudinal band of pale setae mostly on lateral surface of T2, forming weakly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular, with distinct, often pilose, basal crescent; S5 slightly downcurved apically. Male: Pygidial plate relatively long, lateral margins parallel-sided, with distinct transverse basal ridge and apical downturned plate; S4–5 with pale golden to white apical fringes, S2–3 with white apical bands, slightly extended on S3.

Comments.—This species was given the manuscript name "*Triepeolus perpictus*" by Timberlake.

Distribution.—USA: Arizona, California, Colorado, Nevada, Utah.

Floral Records.—*Baileya* sp., *Helianthus petiolaris* Nutt.

Seasonal Records.—April 16 to July 23.

Specimens examined.—14 ♀, 3 ♂ (LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, RIVERSIDE).

TRIEPEOLUS SP. 59

(Figs. 378, 379)

Description.—Length ca. 6–10 mm; ITW 1.3–1.9 mm. Integument black to reddish brown, with dark reddish brown to orange on part of mandible, usually on part or entire labrum, apical margin of clypeus, and pronotal lobe, orange on F1, tegula, and at least middle and hind legs (excluding basal coxae and spurs), usually on scape, pedicel, and front leg, sometimes on axillar spine; dorsally with bands of setae pale yellow. Clypeus shining, lacking or with faint midline, with faint larger punctures (densely covered with setae in male). Mesepisternum apparently lacking or with short, sparse, erect, simple setae, dorsally with dense, pale yellow to white, branched setae, grading to sparser, pale yellow, branched setae ventrally, integument beneath very densely, minutely punctate (female) or entirely covered in dense, branched setae, mostly white except for small, brown, branched, ventroposterior spot (male). Paramedian bands poorly distinguished from diffuse setae on scutum or distinct but contiguous with diffuse lateral setae (specimens from southern locales). Scutellum moderately to strongly bigibbous, often covered with pale setae; axillar spines triangular, shorter than or reaching midpoint of scutellum. T1 interspace narrowly, transversely ovate to nearly subtriangular; T2 with lateral, longitudinal band of pale setae forming strongly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area longitudinally ovate to subquadrate, with distinct silvery basal crescent of fine setae, grading to coarser, golden apical setae; S5 straight in profile to weakly downcurved apically. Male: Pygidial plate somewhat keyhole shaped (only

weakly emarginate laterally); S4–5 with pale brown apical fringes (darker and shorter on S5, white laterally on S4), S2–3 with white apical band of setae.

Comments.—This species strongly resembles both *Triepeolus* spp. 95 and 97. It can be distinguished from them by the by the paramedian bands, which are distinct in those species and at least laterally contiguous with pale setae on the anterior margin of the scutum (sometimes entirely surrounded by pale setae on scutum) in *Triepeolus* sp. 59. In addition, the scutellum of *Triepeolus* sp. 97 is weakly bigibbous, and that species is apparently found only in Texas during the months of March and April. *Triepeolus* sp. 59 can be additionally differentiated from *Triepeolus* sp. 95 by the pseudopygidial area, in which the boundary between the basal and apical regions is strongly demarcated in *Triepeolus* sp. 95, while in *Triepeolus* sp. 59 the two gradually intergrade. *Triepeolus* sp. 59 is also similar to *Triepeolus* sp. 61; see comments under that species for differentiating features. *Triepeolus* sp. 59 also resembles *T. eldoradensis* and *T. fraserae*; see comments under those species for differentiating characters. A specimen of ms. 59 was labeled "PCAM 21" by D. Yanega.

Distribution.—MEXICO: Durango, Sonora; USA: Arizona, California (Riverside Co.), Colorado, Idaho, Nevada, New Mexico, Texas, Utah.

Floral Records.—*Asclepias* sp., *Bahia absinthifolia* var. *dealbata* (Gray) Gray, *Crepis* sp., *Dyssodia* sp., *Euphorbia* sp., *Helianthus* sp., *Melilotus alba* [= *Melilotus officinalis* (L.) Lam.], *Pectis papposa* Harvey & Gray, *Tamarix gallica* L.

Seasonal Records.—June 6 to August 6 (more setose specimens, from Colorado, Idaho, Nevada, and Utah), or August 13 to October 14 (less setose specimens, from remaining locales).

Specimens examined.—96 ♀, 2 ♂ (BOULDER, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, NEW YORK, RIVERSIDE, WASHINGTON D.C.).

TRIEPEOLUS SP. 60

(Figs. 380, 381)

Description.—Length ca. 7–8 mm; ITW 1.5 mm. Integument black, with red on part of mandible, orange on F1, tegula, and legs (excluding basal coxae and spurs); dorsally with bands of setae pale yellow. Clypeus shining, lacking midline, larger punctures present. Mesepisternum with erect, simple setae; dorsal half with dense, white, branched setae (sparser on hypoepimeron), ventrally with sparse, brown, branched setae; punctures small, relatively dense and strongly impressed, punctures separated by up to 1 puncture diameter. Paramedian bands somewhat diffuse, contiguous with lateral bands. Scutellum weakly bigibbous; axillar spines triangular, not or nearly reaching midpoint of scutellum. T1 interspace widely ovate to rectangular; T2 with lateral, longitudinal band of pale setae forming weakly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area triangular, with pilose, coarse setae, elongate on apical margin, basally region with silvery setae; S5 straight in profile. Male: Unknown.

Comments.—The pseudopygidial area of this species resembles that of *T. diversipes*; see comments under that species for differentiating characters.

Distribution.—USA: Arizona (Cochise).

Seasonal Records.—September 17 to September 21.

Specimens examined.—2 ♀ (NEW YORK, TEMPE).

TRIEPEOLUS SP. 61

(Figs. 382, 383)

Description.—Length ca. 7–8 mm; ITW 1.5–1.8 mm. Integument black, with orange on basal mandible, labrum, apical or entire clypeus, scape, pedicel, F1, tegula, and legs (excluding basal coxae and spurs), often on pronotal lobe; dorsally with bands of setae pale yellow. Clypeus with faint midline and larger punctures. Mesepisternum lacking erect, simple setae, dorsally with dense, pale yellow, branched setae, grading ventrally along margins to sparser setae, medially asetose or with sparse, brown, branched setal area, integument shining, punctures small and fairly regularly spaced ca. 0.5 puncture diameter apart. Paramedian bands distinct, or more commonly continuous with lateral setae. Scutellum weakly bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace widely rectangular to subovate, suggesting plus-shaped sign; T2 with lateral, longitudinal band of pale setae mostly on lateral surface of T2, forming weakly acute angle with apical, transverse band of pale setae. Female:

Pseudopygidial area small, subcircular, with basal silvery setae somewhat pilose, with apical setae golden, relatively long; S5 downcurved. Male: Unknown.

Comments.—This species resembles *Triepeolus* sp. 59, but in *Triepeolus* sp. 61 the T1 interspace is more distinctly rectangular (almost forming plus-shaped sign). *Triepeolus* sp. 61 also resembles *Triepeolus* sp. 44, but the former can be differentiated from that species by the downturned profile of the S5 and by the relatively weak differentiation of the apical and basal setae on the pseudopygidial area. This species was identified as "PCAM 22" by D. Yanega.

Distribution.—MEXICO: Chihuahua, Durango; USA: Texas.

Floral Records.—*Coreopsis* sp., *Dyssodia* sp., *Haplopappus gracilis* [= *Machaeranthera gracilis* (Nutt.) Shinners].

Seasonal Records.—April 9 to September 28.

Specimens examined.—22 ♀ (AUSTIN, LAWRENCE, LOS ANGELES, MEXICO CITY, NEW YORK, WASHINGTON D.C.).

TRIEPEOLUS SP. 62

(Figs. 384, 385)

Description.—Length ca. 8 mm; ITW 2.1 mm. Integument black, with red to orange on mandible, labrum, scape, pedicel, F1 (rest of antenna dark reddish brown), pronotal lobe, tegula, and parts of legs (femora and tibiae orange with black patches); dorsally with bands of setae yellow. Clypeus lacking midline, with very faint larger punctures. Mesepisternum lacking erect, simple

setae, dorsally with longitudinal patch of pale yellow, branched setae below scrobal groove, extending between anterior and posterior margins and continuing along posterior margin, also with patch of pale setae near pronotal lobe and on anterior surface of mesepisternum at same level; ventrally with integument shining, with very small, weakly impressed punctures, separated by one or two puncture diameters (one side of mesepisternum with linear area of impunctate integument spanning ca. 5 puncture diameters). Paramedian bands distinct, tapering anteriorly. Scutellum weakly bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace very wide rectangular; both T1 and T2 lacking lateral longitudinal bands of yellow setae; T1–3 apical transverse bands of yellow setae widely interrupted medially (rest of terga not visible). Female: Pseudopygidial area quadrate, poorly differentiated from basal setae on T5, setae fine, apically with patch of golden-reflecting setae (differentiated due to downturn in integument); S5 straight in profile. Male: Unknown.

Comments.—This species was labeled "PCAM-27" by D. Yanega.

Distribution.—MEXICO: Hidalgo.

Host Records.—*Tetraloniella* (*Pectinapis*) sp.? (1 specimen: "Mexico: Hidalgo, 25 km SW Metzquititlan, 11 Nov 1991. Noguera, 1860m, near top of valley, *Pectinapis* in Salvia woods").

Seasonal Records.—November 11.

Specimens examined.—1 ♀ (LAWRENCE).

TRIEPEOLUS SP. 63

(Figs. 386, 387)

Description.—Length ca. 7–8 mm; ITW 1.4–1.9 mm. Integument black to reddish brown (due to preservation?), with orange on part of mandible, part or entire labrum, F1, tegula, and at least middle and hind legs, sometimes also on front leg (excluding basal coxae and spurs), sometimes on apical margin of clypeus, scape, pedicel, and part of pronotal lobe; dorsally with bands of setae pale yellow. Clypeus somewhat protuberant, with faint midline and larger punctures, sometimes with sparse white setae directed medially. Mesepisternum lacking or with sparse, short, erect, simple setae; dorsal half with dense, white, branched setae (sparser on hypoepimeron), grading ventrally to sparse, white, branched setae; with punctures rather deeply impressed, nearly contiguous to separated by 0.5 puncture diameter. Paramedian bands laterally contiguous with pale band of setae on anterior margin of scutum. Scutellum moderately to weakly bigibbous; axillar spine triangular, reaching midpoint of scutellum. T1 interspace widely ovate to rectangular; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area widely triangular, mostly composed of coarse, long setae, basally with small area of silvery shining setae; S5 straight in profile.

Distribution.—USA: Arizona, Colorado, New Mexico.

Floral Records.—*Asclepias subverticillata* (A. Gray) Vail, *Heterotheca* sp.

Seasonal Records.—July 15 to September 9.

Specimens examined.—7 ♀ (LAWRENCE, LOS ANGELES, NEW YORK, TEMPE, WASHINGTON D.C.).

TRIEPEOLUS SP. 65

(Figs. 388, 389)

Description.—Length ca. 7–9 mm; ITW 1.4–1.9 mm. Integument black or reddish brown, with red to orange on mandible, scape, pedicel, F1, and legs (excluding basal coxae, sometimes excluding spurs), often on labrum, part or entire clypeus, pronotal lobe, and tegula; dorsally with bands of setae pale yellow. Clypeus lacking midline or with faint midline, with faint large punctures. Mesepisternum lacking erect, simple setae; dorsal half with dense, pale yellow, branched setae, sometimes extending along posterior margin of mesepisternum near midcoxa; punctation small, moderately impressed, spaced almost contiguously to nearly 1 puncture width apart in some areas. Paramedian bands relatively long, usually laterally contiguous with pale setae on anterior margin of scutum (sometimes poorly distinct from diffuse pale setae on lateral and anterior margins of scutum). Scutellum moderately to weakly bigibbous, often with longitudinal line of pale yellow setae between biconvexities; axillar spines triangular, reaching or rarely surpassing midpoint of scutellum. T1 interspace widely ovate or nearly diamond shaped, apical and basal transverse bands of pale setae usually narrowly interrupted; T2 with lateral, longitudinal band of pale setae

forming 90 degree angle with apical, transverse band of pale setae (sometimes this angle appearing strongly acute due to sparser pale setae at junction of apical and lateral bands). Female: Pseudopygidial area subquadrate, with setae uniformly semi-erect, dense, fine, apically downturned, and sometimes directed slightly laterally; apical margin of pseudopygidial area straight or appearing slightly concave due to long lateral setae at apical margin; S5 straight in profile. Male: Unknown.

Comments.—This species somewhat resembles *Triepeolus* sp. 179 in the uniformly golden brown pseudopygidial area; see comments under that species for differentiating characters.

Distribution.—MEXICO: Chihuahua, Coahuila; USA: Arizona, Kansas, New Mexico, Oklahoma, Texas, Utah.

Host Records.—*Dieunomia* (*Epinomia*) *nevadensis* (Cresson) (6 specimens, from nest area, Cochise Co., Arizona), *Protoxaea* sp. (2 specimens, from "nest #1", Cochise Co., Arizona).

Seasonal Records.—May 23 to September 20.

Specimens examined.—38 ♀ (AUSTIN, DAVIS, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, WASHINGTON D.C.).

TRIEPEOLUS SP. 74

(Figs. 390, 391)

Description.—Length ca. 10–13.5 mm; ITW 2.0–2.9 mm. Integument black, with bright reddish orange on basal mandible, labrum, apical margin of clypeus, scape, pedicel, F1, and base of F2, tegula, and sometimes on part of pronotal lobe, legs (excluding basal coxae and spurs), and apically on axillar spines; dorsally with bands of setae pale yellow. Clypeus relatively flat in profile, shining, with midline and larger punctures present. Mesepisternum lacking or with very sparse, short, erect, simple setae; dorsal half covered with pale yellow, branched setae (lacking or brown on hypoepimeron), ventrally with integument mostly asetose, shining, with punctures nearly contiguous separated by up to 1.5 puncture widths). Paramedian bands distinct, in some specimens slightly curving outward anteriorly. Scutellum strongly to moderately bigibbous; axillar spines triangular, reaching scutellar midpoint, often with pale yellow setae in inner lateral margin. T1 interspace widely ovate/subquadrate, rarely subtriangular, apical and basal transverse bands of pale yellow setae interrupted medially; T2 with lateral, longitudinal band of pale setae mostly on lateral surface of T2, forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area triangular to subquadrate, mostly composed of narrow, suberect, relatively sparse setae, with narrow basal region of fine, coppery setae; S5 straight in profile. Male: Unknown.

Comments.—This species resembles *Triepeolus* sp. 2, but in *Triepeolus* sp. 74 the pseudopygidial area is not so distinctly triangular and the coarse apical setae are slightly longer, the T1 interspace is more ovate, and the paramedian

bands are not laterally contiguous with other pale yellow setae on the anterior margin of the scutum. This species was labeled "PCAM 7" by T. Griswold; it was also given the morphospecies number 6 by Paul Hurd.

Distribution.—MEXICO: Baja California, Chihuahua, Durango, Zacatecas; USA: Arizona, New Mexico.

Floral Records.—*Eriogonum deflexum* Torr., *Helianthus annuus* L., *Heterotheca subaxillaris* (Lam.) Britt. & Rusby, *Kallstroemia grandiflora* Torr. ex Gray, *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray.

Seasonal Records.—August 4 to October 12.

Specimens examined.—70 ♀ (BERKELEY, DAVIS, LAWRENCE, LOGAN, MEXICO CITY, NEW YORK, RIVERSIDE, SAN FRANCISCO, TEMPE, WASHINGTON D.C.).

TRIEPEOLUS SP. 76

(Figs. 392, 393)

Description.—Length ca. 10–15 mm; ITW 2.0–2.7 mm. Integument black, with red on part of mandible and F1, rarely on part of labrum, scape, and pedicel, orange on legs (excluding basal coxae and spurs), pale brownish orange on tegula; dorsally with bands of setae pale yellow. Clypeus with faint midline and very faint larger punctures. Mesepisternum lacking erect, simple setae, with dense, pale yellow, branched setae on small region below scrobal groove and dorsally on anterior surface of mesepisternum; ventrally mostly asetose, punctures

small, deeply impressed, and nearly contiguous. Paramedian bands distinct or laterally contiguous with pale setae on anterior margin of scutum. Scutellum moderately to strongly bigibbous; axillar spines triangular, surpassing scutellum midpoint, apical point somewhat curved inward. T1 interspace widely quadrate to ovate, basal and apical transverse bands of pale setae slightly interrupted medially; T2 with lateral, longitudinal band of pale setae mostly on lateral surface of T2, forming weakly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area elongate, longitudinally ovate, basal half with dense, silvery, fine, pilose setae (this region of silvery setae with basal margin often notched mediobasally), apical half with rounded region of coarse, sparse setae; S5 strongly downcurved. Male: Unknown.

Distribution.—USA: Arizona, Colorado, Idaho, Kansas, Nebraska, New Mexico, North Dakota, Oregon, Utah, Washington.

Host Records.—*Melissodes* (*Eumelissodes*) *pallidisignata* Cockerell? (1 specimen from nest site, Yakima Co., Washington); "going into *Nomia*, *Melissodes*, etc. nest holes" (1 specimen from Boulder Co., Colorado); "flying around ground where *Melissodes* nests" (1 specimen from Boulder Co., Colorado).

Floral Records.—*Chrysothamnus nauseosus* [= *Ericameria nauseosa* (Pallas ex Pursh) Nesom & Baird], *Grindelia squarrosa* (Pursh) Dunal, *Helianthus* sp., *Heterotheca* sp., *Melilotus* sp.

Seasonal Records.—July 27 to October (day unspecified).

Specimens examined.—43 ♀ (BOULDER, DAVIS, ITHACA, LAWRENCE, LOGAN, LOS ANGELES, MILICZKY, NEW YORK, SAN DIEGO, WASHINGTON D.C.).

TRIEPEOLUS SP. 78

(Figs. 394, 395)

Description.—Length ca. 7–10 mm; ITW 1.6–2.2 mm. Integument black, often with red on part of mandible and outer F1; dorsally with bands of setae pale yellow. Clypeus with faint midline and distinct larger punctures; face with transverse area of white setae at level of antennal sockets, excluding supraclypeal area (females), or covered with dense, white setae (males). Mesepisternum apparently lacking or with sparse, short, erect, simple setae; dorsal third (excluding hypoepimeron) with dense, pale yellow, branched setae, ventrally with short, black, branched setae (females), or entire mesepisternum covered with dense, pale yellow, branched setae (males); punctation very small and dense, only occasionally punctures separated by ca. half puncture diameter, this integument appearing raised, somewhat tuberculate. Paramedian bands distinct and robust (females) or surrounded by diffuse pale setae on entire or anterior half of scutum (males). Scutellum strongly bigibbous; axillar spines triangular, slightly exceeding midpoint of scutellum, apical point slightly incurved. T1 narrowly rectangular; T2 with lateral, longitudinal band of pale setae forming 90 degree or weakly acute angle with apical, transverse band of pale setae; all metasomal terga with apical transverse bands of pale setae not or only slightly medially

interrupted. Female: Pseudopygidial area triangular to subquadrate, with basal setae fine, dense, and silvery, extending apicolaterally and partially surrounding apicomedial area of coarser, longer setae; S5 straight in profile; S4 sometimes with small, apicolateral patch of white setae. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and moderately downturned apical plate; S4–5 with dark brown apical fringes of setae; S2–3 with white apical bands of setae usually restricted to laterally.

Comments.—This species is noteworthy for its apparent endemism in Antioch, California. It strongly resembles *Triepeolus* sp. 144, the latter of which is also noteworthy for its apparently limited range in San Louis Obispo Co., California. The two species can be distinguished by the metasomal terga, which have distinctly different apical transverse bands of pale yellow setae (strongly interrupted medially in *Triepeolus* sp. 144, continuous or nearly continuous in *Triepeolus* sp. 78), and by the red integument on the labrum and legs of *Triepeolus* sp. 144. This species less strongly resembles *Triepeolus* sp. 134; see comments under that species for distinguishing features.

Distribution.—USA: California (Antioch).

Floral Records.—*Eriogonum* sp.

Seasonal Records.—August 23 to October 17.

Specimens examined.—6 ♀, 10 ♂ (ANN ARBOR, LOGAN, NEW YORK, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS SP. 80

(Figs. 396, 397)

Description.—Length ca. 10–11 mm; ITW 2.2–2.3 mm. Integument black, with orange on labrum and apical margin of clypeus, orange-brown on scape, pedicel and F1, and reddish brown on pronotal lobe, tegula, and legs. Clypeus with very faint midline. Mesepisternum lacking erect, simple setae but with suberect, branched setae near pronotal lobe and tegula (especially in male), dorsally with rather diffuse, white, branched setae; punctures small, weakly impressed, separated by 1 to 2 puncture widths (occasionally up to 4 puncture diameters ventrally; integument shining). Paramedian bands long, poorly distinguished from diffuse apical setae. Scutellum strongly to moderately bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace widely quadrate, basal and apical bands slightly interrupted medially; T2 with lateral, longitudinal band of pale setae mostly on lateral surface of T2, forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area subquadrate, entirely composed of fine, long setae; basal half to third with setae forming inverted V-shaped area of silvery reflectance; apically with setae slightly coarser, reflecting golden; S5 straight in profile, instead slightly convex along longitudinal midline. Male: Pygidial plate red, strongly keyhole shaped, with faint basal transverse ridge; S5 with brown, and S4 with white and golden brown, apical fringes; S2–3 with white apical bands of setae (slightly extending past apical margin on S3).

Comments.—This species can be distinguished by the very unusual pseudopygidial area (similar to that of *T. rohweri*; see comments under that species), and by the rather unusual widely quadrate T1 interspace shape, the diffuse setae on the anterior margin of the scutum, and the red pronotal lobe. I have only seen three specimens of this species, all from middle and southern Texas, flying in May. Two specimens were taken on *Gaillardia*.

Distribution.—USA: Texas [Goliad Co., Goliad; Blanco Co., Pedernales Falls State Park].

Floral Records.—*Gaillardia* sp.

Seasonal Records.—May 7 to May 15.

Specimens examined.—2 ♀, 1 ♂ (AUSTIN, LAWRENCE).

TRIEPEOLUS SP. 81

(Figs. 398, 399)

Description.—Length ca. 7–10.5 mm; ITW 1.5–1.8 mm. Integument black, with dark red to orange part of mandible, scape, pedicel, F1, and pronotal lobe, orange on tegula and legs (excluding basal coxae); dorsally with bands of setae pale yellow. Clypeus with faint midline and larger punctures. Mesepisternum lacking erect, simple setae, dorsal half with dense, pale yellow to white, branched setae (excluding or sparser on hypoepimeron), ventral half with sparse pale setae along margins, medioventrally asetose or with sparse, branched, pale setae, punctures nearly contiguous to separated by a puncture diameter, with

integument between punctures raised, tuberculate. Paramedian bands distinct or laterally contiguous with pale setae on anterior of scutum. Scutellum moderately bigibbous; axillar spines triangular, almost reaching scutellum midpoint. T1 interspace widely ovate or subquadrangular; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area longitudinally ovate, almost tear shaped, entirely composed of very dense, pilose setae, basally with distinct region of silvery setae contrasted with apical region of golden setae; S5 straight in profile to faintly downcurved apically. Male: Unknown.

Comments.—The pseudopygidial area of this species resembles that of *T. rohweri*; see comments under that species.

Distribution.—MEXICO: Chihuahua [10 mi W Jiminez (sic.)], Durango (Cuencame Dist., Yerbanis).

Seasonal Records.—August 19 to September 11.

Specimens examined.—2 ♀ (NEW YORK).

TRIEPEOLUS SP. 90

(Figs. 400–402)

Description.—Length ca. 10.0–10.5 mm; ITW 1.9–2.1 mm. Integument black, with orange on basal mandible, labrum, scape, pedicel, F1, tegula, apex of axillar spine, and legs (excluding basal coxae and spurs), sometimes on clypeus, pronotal lobe, metepisternum, and ventral metasoma; dorsally with bands of setae

pale yellow. Clypeus with faint midline, covered with relatively dense, medially-directed white setae. Mesepisternum with sparse, short, erect, simple setae; mostly covered with dense, pale yellow, branched setae (sparser ventrally), also with small patch brown, branched setae medioapically; ventral punctures obscured by setae, apparently nearly contiguous. Paramedian bands barely laterally contiguous with pale setae on apical margin of scutum. Scutellum weakly bigibbous, mostly covered with appressed setae so that only biconvexities lack setae, forming distinctive round spots laterally on scutellum; axillar spines triangular, apical point surpassing midpoint of scutellum. T1 interspace very wide subtriangular; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae; apical bands of all terga continuous. Female: Pseudopygidial area semicircular to subquadrate, with distinct basal shining crescent; S5 straight in profile. Male: Unknown.

Comments.—This species strongly resembles *Triepeolus* sp. 92, especially in the circles of dark setae on the biconvexities of the scutellum. The two species can be differentiated by the mesepisternum and clypeus, which are densely punctate, not shining, in *Triepeolus* sp. 90, and by the pseudopygidial area, which has greater distinction between the basal and apical setae in *Triepeolus* sp. 90.

Distribution.—USA: Arizona (Yuma Co.), California (Orange Co.).

Seasonal Records.—May 1 to August 17.

Specimens examined.—2 ♀ (LOGAN, SAN FRANCISCO).

TRIEPEOLUS SP. 92

(Figs. 403, 404)

Description.—Length ca. 7.5–11 mm; ITW 1.4–2.2 mm. Integument black to reddish brown, with red to orange on basal mandible, scape, pedicel, F1, and legs (excluding basal coxae and spurs), usually on at least part of labrum, apical margin of clypeus, and tegula, sometimes on apex of axillar spine; dorsally with bands of setae pale yellow. Clypeus shining, with midline dorsally and larger punctures, sometimes mostly covered with white setae (males). Mesepisternum with sparse, relatively short, erect, simple setae; dorsally with dense, pale, branched setae, ventrally mostly asetose, integument shining, with small, weakly impressed punctures (separated by a puncture width to 5 puncture widths in some specimens), or with diffuse, branched setae covering most of mesepisternum (males). Paramedian bands distinct, reaching anterior margin of scutum, often tapering anteriorly, or contiguous with lateral setae (some males). Scutellum weakly to moderately bigibbous, mostly covered with appressed setae so that only biconvexities lack setae, forming distinctive round spots laterally on scutellum; axillar spines triangular, reaching or slightly surpassing midpoint of scutellum. T1 interspace widely ovate/subtriangular, basal and apical bands continuous (basal band sometimes slightly interrupted); T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae; apical bands of all terga continuous. Female: Pseudopygidial area

subquadrate, with vague basal crescent; S5 straight in profile. Male: Pygidial plate moderate size, lacking strongly delineated apical downturned plane; S4–5 with golden to pale golden apical fringes; S2–3 with white apical bands.

Comments.—This species strongly resembles morphospecies 90; see comments under that species for differentiating characters.

Distribution.—MEXICO: Baja California, Baja California Sur; USA: Arizona, New Mexico, Texas.

Host Records.—*Svastra* (*Idiomelissodes*) *duplocincta* Cockerell (1specimen collected as larva from nest, Pima Co., Arizona; reared to adult by J. G. Rozen, Jr.).

Floral Records.—*Aplopappus gracilis* [= *Machaeranthera gracilis* (Nutt.) Shinners], *Bahia absinthifolia* var. *dealbata* (Gray) Gray, *Eriogonum deflexum* Torr., *Ferocactus* sp., *Melilotus alba* [= *Melilotus officinalis* (L.) Lam.].

Seasonal Records.—June25 to October 10.

Specimens examined.—39 ♀, 6 ♂ (AUSTIN, DAVIS, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, RIVERSIDE, SAN FRANCISCO, URBANA, WASHINGTON D.C.).

TRIEPEOLUS SP. 95

(Figs. 405, 406)

Description.—Length ca. 7–10 mm; ITW 1.5–2.0 mm. Integument black, with red to orange on part of mandible, labrum, apical margin of clypeus, and F1,

usually also on scape, pedicel, and pronotal lobe, orange on tegula and legs (excluding basal coxae and spurs); dorsally with bands of setae pale yellow. Clypeus shining, lacking or with faint midline, with distinct larger punctures. Mesepisternum lacking erect, simple setae, dorsally and on margins with dense, pale yellow, branched setae (sparser on hypoepimeron and ventrally on margins), medioventrally with black, circular, asetose area (sometimes with sparse, pale, branched setae medially); punctures relatively small, irregular, almost contiguous to separated by 0.5 puncture diameter in some places. Paramedian bands distinct. Scutellum moderately bigibbous; axillar spines triangular, almost reaching or reaching midpoint of scutellum. T1 interspace widely ovate to subquadrate; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular, with basally and along lateral margins with silvery, pilose setae, mostly enclosing circular, medioapical area of coarse setae; S5 straight in profile or slightly downcurved apically. Male: Unknown.

Comments.—This species was labeled "PCAM 25" by D. Yanega. It resembles *Triepeolus* sp. 59, *Triepeolus* sp. 177, *T. laticaudus*, and *T. occidentalis*; see comments under those species for differentiating features.

Distribution.—MEXICO: Chihuahua; USA: Arizona, Colorado (Boulder Co.), New Mexico, Texas (Yoakum Co.).

Host Records.—*Xenoglossodes* (= *Tetraloniella*) (1 specimen flying in nesting area, Cochise Co., Arizona).

Floral Records.—*Aster* sp. (= *Symphyotrichum*), *Baccharis glutinosa* [= *Baccharis salicifolia* (Ruiz & Pavón) Pers.], *Baileya multiradiata* Harv., *B. pleniradiata* Harvey & Gray ex Gray, *Chrysothamnus* sp., *Eriogonum* sp., *Heliopsis* sp., *Heterotheca subaxillaris* (Lam.) Britt. & Rusby, *Kallstroemia grandiflora* Torr. ex Gray, *Poliomintha incana* (Torr.) Gray, *Sphaeralcea* sp., *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray.

Seasonal Records.—May 8 to October 13.

Specimens examined.—71 ♀ (BOULDER, CORVALLIS, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, RIVERSIDE, SAN FRANCISCO, TEMPE, WASHINGTON D.C.).

TRIEPEOLUS SP. 97

(Figs. 407, 408)

Description.—Length ca. 7–10 mm; ITW 1.5–2.0 mm. Integument black, with red to orange on part of mandible and part or entire labrum, often on apical margin of clypeus, orange on scape, pedicel, F1, part or entire pronotal lobe, tegula, and legs (excluding very basal part of coxae, and sometimes spurs); dorsally with bands of setae pale yellow. Clypeus with elevated midline and distinct larger punctures, sometimes sparsely covered with white setae. Mesepisternum lacking erect, simple setae, dorsally with dense, pale yellow, branched setae, grading to slightly sparser, pale, branched setae ventrally, sometimes with ventral setae worn partially away, with integument punctation

very small, almost contiguous. Paramedian bands distinct or barely contiguous with lateral setae. Scutellum weakly bigibbous; axillar spines triangular, reaching or almost reaching midpoint of scutellum. T1 interspace subquadrate to subovate; T2 with lateral, longitudinal band of pale setae forming acute to weakly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular to subquadrate, basally with silvery, somewhat pilose crescent; S5 straight in profile. Male: Unknown.

Comments.—This species strongly resembles *Triepeolus* sp. 59, but the scutum is not covered with diffuse pale setae in *Triepeolus* sp. 97 (as it often is in *Triepeolus* sp. 59), and *Triepeolus* sp. 97 is found in March and April, while specimens of *Triepeolus* sp. 59 from Texas are apparently found in mid-July. This species also resembles *T. norae*, but the axillar spines not as long in *Triepeolus* sp. 97 as in *T. norae*, and the basal silvery setae of the pseudopygidial area are less strongly differentiated from the coarser setae of the basal region. *Triepeolus norae* is found between April and October.

Distribution.—USA: Texas [Dimmit Co., Hidalgo Co., Maverick Co., Uvalde Co., Val Verde Co., Zapata Co.].

Floral Records.—*Aphanostephus* sp., *Helenium microcephalum* DC., *Opuntia* sp., *Parkinsonia* sp.

Seasonal Records.—March 29 to April 27.

Specimens examined.—19 ♀ (AUSTIN, LAWRENCE, NEW YORK).

TRIEPEOLUS SP. 110

(Figs. 409, 410)

Description.—Length ca. 8–10 mm; ITW 1.6–1.8 mm. Integument black, with red on part of mandible, brownish orange on anterior surface of antenna, sometimes on tegula; dorsally with bands of setae pale yellow. Clypeus with faint to dorsally well-defined midline and distinct larger punctures. Mesepisternum lacking erect, simple setae, dorsal third, except hypoepimeron, covered with dense, pale yellow, branched setae, faintly extending along anterior margin of mesocoxa, lacking on anterior surface of mesepisternum; ventral integument shining, with punctures nearly contiguous to separated by 1 puncture diameter. Paramedian bands distinct. Scutellum weakly bigibbous; axillar spines triangular, almost reaching midpoint of scutellum. T1 widely quadrate, with apical and basal transverse bands of pale setae interrupted medially; T2 with lateral, longitudinal band of pale setae mostly on lateral surface of T2, forming weakly acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area semicircular, with setae uniformly glossy, dark, and fine except for vague basal crescent of slightly denser, finer, shorter setae (this crescent seemingly formed by elevation in integument); S5 straight in profile. Male: Unknown.

Comments.—This species is similar to *T. laticeps* and *T. tepanecus*; in particular, a large specimen from Sonora strongly resembles *T. laticeps*, but in *Triepeolus* sp. 110 the axillar spine is smaller, there are more pale, branched setae dorsally, and less anteriorly, on the mesepisternum, the T1 interspace is more

distinctly quadrate, and the apical transverse bands of pale setae on T2–3 are interrupted medially. See Table 5 for further characteristics of these species.

Distribution.—MEXICO: Sinaloa, Sonora; USA: Arizona.

Floral Records.—"blue Malvaceae".

Seasonal Records.—August 26 to November 28.

Specimens examined.—9 ♀ (LOGAN, LOS ANGELES).

TRIEPEOLUS SP. 134

(Figs. 411–413, 487)

Description.—Length ca. 10.5–11.5 mm; ITW 2.1–2.4 mm. Integument black, with red to orange on part of mandible and outer F1, and sometimes on legs (excluding basal coxae and spurs); dorsally with bands of setae very pale yellow. Clypeus lacking midline, with distinct larger punctures; face entirely dark except with small areas of white setae near anterior tentorial pits and antennal bases (females), or entirely covered with dense, white setae (males). Mesepisternum with erect, simple setae, dorsally with small patch appressed, pale yellow, branched setae between pronotal lobe and hypoepimeron (females) or entire upper third (or more) covered with appressed, white, branched setae (males), ventrally with diffuse, black, branched setae; punctures rough, nearly contiguous to separated by nearly a puncture diameter in some areas, with integument between raised and somewhat shining. Paramedian bands relatively long, mostly distinct but sometimes with some diffuse setae medially (females), or nearly indistinct

from diffuse, pale setae on anterior to entire scutum (males). Scutellum weakly to moderately bigibbous; axillar spines triangular, reaching or not quite reaching midpoint of scutellum. T1 interspace narrow, transversely rectangular or partially covered with sparser, pale setae to form triangular or rarely very small, circular area; T2 with lateral, longitudinal band of pale setae reduced, forming 90 degree angle with apical, transverse band of pale setae; pale, apical transverse bands of all terga robust, not medially interrupted. Female: Pseudopygidial area poorly differentiated from rest of T5, represented by a flattened, dark, semicircular plane, with very vague basal crescent; T5 with lateral pale setae reduced or absent; S5 very faintly downcurved; mesosoma and metasomal venter entirely black. Male: Pygidial plate keyhole shaped, with poorly differentiated transverse basal ridge and weakly downturned apical plate; S4–5 with black apical fringes of setae; S2–3 with white, apical bands of setae restricted to lateral margins.

Comments.—Various specimens of this species bear Timberlake manuscript names meaning "beautiful" and "from Siskiyou." The dorsal aspect of this species strongly resembles *Triepeolus* sp. 78, but the two species can be differentiated by the female T5 (the pseudopygidial area of *Triepeolus* sp. 78 has a distinctly differentiated basal region of silvery setae, as well as a large patch of white setae lateral to the pseudopygidial area).

Distribution.—USA: California (Lassen Co., Modoc Co., Siskiyou Co.), Oregon (Klamath Co.).

Floral Records.—*Chrysothamnus nauseosus* [= *Ericameria nauseosa* (Pallas ex Pursh) Nesom & Baird].

Seasonal Records.—August 21 to September 22.

Specimens examined.—10 ♀, 4 ♂ (BERKELEY, CORVALLIS, DAVIS, GAINESVILLE, LOGAN).

TRIEPEOLUS SP. 141

(Figs. 414, 415)

Description.—Length ca. 7–10.5 mm; ITW 1.4–1.8 mm. Integument black, with red on part of mandible, orange on F1, sometimes on tegula and part or most of legs; dorsally with bands of setae yellow to yellow-orange. Clypeus with faint or strong midline and faint larger punctures, sometimes covered with diffuse white setae (females), or entirely covered by dense, white setae (males). Mesepisternum lacking or with very sparse, short, erect, simple setae, with sparse, pale, branched setae near pronotal lobe and sometimes beneath scrobal groove; ventrally asetose, with integument shining, punctures nearly contiguous to separated by ca. 0.5 puncture width (females), or entire mesepisternum except hypoepimeron covered with dense, white (intermixed with brown posteroventrally), branched setae (males). Paramedian bands absent or less commonly present (specimen from Hidalgo). Scutellum weakly bigibbous; axillar spines triangular, reaching or almost reaching midpoint of scutellum. T1 lacking basal transverse band of yellow setae, or sometimes with basal band reduced to

patch on anterolateral corner; apical transverse band of yellow setae interrupted medially; T2 with lateral, longitudinal band of pale setae absent. Female: Pseudopygidial area semicircular to subquadrate, with vague basal crescent of shining setae; S5 straight in profile. Male: Pygidial plate keyhole shaped, with somewhat weak basal transverse ridge and apical downturned plate; S4–5 with apical fringes of setae white, intermixed with brown on S5; S2–3 with apical bands of white setae (S3 white setae slightly surpassing apical margin).

Comments.—This species strongly resembles *Triepeolus* sp. 142, but can be distinguished from that species by the medially-interrupted transverse band of yellow setae on the apical margin of the T1. In addition, the species differ in the relative abundance of erect, simple setae on the mesepisternum, and usually in the presence of paramedian bands of pale setae on the scutum. This species was identified as "PCAM 32" by D. Yanega.

Distribution.—MEXICO: Guanajuato, Hidalgo, Michoacán, Morelos, Zacatecas.

Host Records.—*Atoposmia* sp.? (1 specimen: "Mexico: Hidalgo 4km SW Metzquititlan, 11 Nov 1991. Noguera, 1580m, rocky hillside, composites, *Anthocopa* on rock wall").

Seasonal Records.—September 7 to December 6.

Specimens examined.—6 ♀, 1 ♂ (LAWRENCE, LOGAN, MEXICO CITY).

TRIEPEOLUS SP. 142

(Figs. 416, 417)

Description.—Length ca. 7–8.5 mm; ITW 1.4–1.8 mm. Integument black, with red on part of mandible, orange on F1 (sometimes also on F2–5); dorsally with bands of setae yellow-orange. Clypeus with strong midline and faint larger punctures, covered with dense white setae in males. Mesepisternum with dense but very short, erect, simple setae, with punctures small, nearly contiguous; females with small dorsal patch of pale yellow, branched setae below scrobal groove, males with denser branched setae (white dorsally and anteriorly, rest brown) covering much of mesepisternum . Paramedian bands very narrow and reduced, distinct. Scutellum weakly bigibbous; axillar spines triangular, not or nearly reaching midpoint of scutellum. T1 usually lacking basal band of transverse yellow setae (sometimes very faintly present), with lateral longitudinal bands of yellow setae reduced but often present on basolateral corner; T1–4 each with single, straight, uninterrupted apical transverse band of yellow setae; T2 with lateral, longitudinal band of pale setae absent. Female: Pseudopygidial area subquadrate, with very faintly differentiated basal crescent of silvery setae, mostly composed of relatively long, coarse, golden setae; S5 straight in profile. Male: Pygidial plate keyhole shaped, with distinct transverse basal ridge and apical downturned plate; S4–5 with pale golden apical fringes, S2–3 with white apical bands (S3 white setae slightly extended past apical margin).

Comments.—This species strongly resembles *Triepeolus* sp. 141; see comments under that species for differentiating characters. The numerous specimens of this species were almost entirely collected by Frank Parker, with the exception of a nine specimens housed in the Berlin Museum.

Distribution.—COSTA RICA: Guanacaste, San José.

Seasonal Records.—November 18 to March 23.

Specimens examined.—137 ♀, 207 ♂ (LOGAN).

TRIEPEOLUS SP. 143

(Figs. 418, 419)

Description.—Length ca. 7–8.5 mm; ITW 1.5–2.0 mm. Integument black, with red on part of mandible; dorsally with bands of setae pale yellow. Clypeus lacking midline and larger punctures, sometimes covered with diffuse, white setae. Mesepisternum with dorsal third covered with white, branched, suberect setae; anterior margin with long, erect to suberect, brown, branched and simple setae; ventrally with punctures nearly contiguous, covered with diffuse, brown, branched setae (denser in males). Paramedian bands distinct, reaching anterior margin of scutum, sometimes curving outwards anteriorly, or absent (possibly due to wear?). Scutellum weakly bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace subtriangular; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area subquadrate, poorly differentiated

from rest of T5 (except for dark color contrasting with white setae laterally on T5), apical margin with transverse patch shining, silvery setae; S5 straight in profile. Male: Pygidial plate extremely narrow; S4–5 with dark brown apical fringes (no white setae on metasomal sterna).

Comments.—This species is similar to *T. heterurus*, and often collected at the same localities; see comments under that species for differentiating characters. A specimen of this species bears a manuscript name (authorship not given) relating to Mariposa.

Distribution.—USA: California.

Floral Records.—*Grindelia camporum* Greene, *Hemizonia* sp., *Marrubium vulgare* L., *Petroselinum crispum* (P. Mill.) Nyman ex A.W. Hill, *Salvia* sp.

Seasonal Records.—May 24 to October 22.

Specimens examined.—88 ♀, 78 ♂ (BERKELEY, DAVIS, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, NEW YORK-ASCHER, RIVERSIDE, SAN FRANCISCO, URBANA, WASHINGTON D.C.).

TRIEPEOLUS SP. 144

(Figs. 420, 421)

Description.—Length ca. 10–10.5 mm; ITW 2.2–2.3 mm. Integument black, with red on part of mandible, labrum, apical clypeus, tegula, and parts of legs (especially distal to femora), sometimes on scape, pedicel, F1, and pronotal

lobe; dorsally with bands of setae pale yellow. Clypeus with faint midline, mostly covered with diffuse, dark brown setae; face with transverse area of white setae at level of antennal sockets, excluding supraclypeal area. Mesepisternum with short, erect, simple setae; with small patch of yellow, branched setae below scrobal grove and beneath pronotal lobe; punctation very small and nearly contiguous. Paramedian bands distinct. Scutellum strongly bigibbous; axillar spines triangular, slightly surpassing midpoint of scutellum, apical point directed inward. T1 interspace widely rectangular; T2 with lateral, longitudinal band of pale setae reduced, seemingly forming 90 degree angle with apical, transverse band of pale setae; all metasomal terga with apical transverse bands of pale yellow setae medially interrupted by ca. 1 OD (slightly less on posterior-most terga). Female: Pseudopygidial area triangular to subquadrate, basally with very fine, silvery setae, apically half to two-thirds with coarse, apically-downturned setae; S5 straight in profile. Male: Unknown.

Comments.—This species resembles *Triepeolus* sp. 78 and specimens of *Triepeolus* sp. 42 from California; see comments under the latter species for differentiating characters.

Distribution.—USA: California (San Luis Obispo).

Seasonal Records.—August 29 to September 12.

Specimens examined.—2 ♀ (DAVIS, LOGAN).

TRIEPEOLUS SP. 170

(Figs. 422, 423)

Description.—Length ca. 8.5 mm; ITW 2.0 mm. Integument black, with reddish brown on part of mandible, labrum, apical clypeus, pronotal lobe, basal to tibia on legs, orange on F1, tegula, and apical to femora legs; dorsally with bands of setae pale yellow. Clypeus lacking midline, with faint larger punctures. Mesepisternum (and most of mesosoma) with erect, simple setae; dorsal half and ventral margin covered with long, pale yellow, branched setae (sparser on hypoepimeron), medioventrally with wide, circular region of sparse, black, branched setae; with punctures nearly contiguous. Paramedian bands distinct. Scutellum weakly bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace subovate, enlarged medially by indentations in basal and apical longitudinal bands of pale yellow setae; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female pseudopygidial area tear-shaped, entirely with dense, fine, silvery setae, apically with circular region of integument strongly depressed; S5 strongly downcurved. Male: Unknown.

Comments.—The sole specimen of this unusual species bears a label with a manuscript name (authorship not given) referring to the silvery setae of the pseudopygidial area.

Distribution.—USA: California (The Gavilan, Riverside Co.).

Floral Records.—*Helianthus gracilentus* Gray.

Seasonal Records.—June 9.

Specimens examined.—1 ♀ (LOGAN).

TRIEPEOLUS SP. 174

(Figs. 424, 425)

Description.—Length ca. 10–10.5 mm; ITW 2.2–2.6 mm. Integument black, with red on part of mandible, sometimes on margins of labrum and apically on clypeus, orange to red on F1, sometimes on parts of scape, pedicel, and pronotal lobe, orange on legs (excluding basal coxae and spurs), orange to pale brown on tegula; dorsally with bands of setae pale yellow. Clypeus with faint midline and larger punctures (sometimes covered by setae). Mesepisternum with long, erect, simple setae; mostly covered by pale, branched, yellow subappressed setae but with shining, somewhat tuberculate, black integument visible beneath setae ventrally. Paramedian bands somewhat diffuse, joined laterally to pale setae on anterior of scutum. Scutellum moderately to weakly bigibbous; axillar spines triangular, slightly flattened, reaching midpoint of scutellum. T1 interspace widely, distinctly rectangular; T2 with lateral, longitudinal band of pale setae forming 90 degree angle with apical, transverse band of pale setae. Female pseudopygidial area semicircular to subquadrate, with vaguely differentiated basal crescent of golden shining setae; S5 slightly downcurved apically. Male: Unknown.

Distribution.—USA: Texas (sic; should be New Mexico?) (McKinley Co., Tohatchi), Utah (Garfield Co., Calf Creek).

Floral Records.—*Chrysothamnus* sp., *Senecio longilobus* (= *Senecio flaccidus* Less. var. *flaccidus*).

Seasonal Records.—August 29 to September 21.

Specimens examined.—3 ♀ (LOGAN).

TRIEPEOLUS SP. 177

(Figs. 426, 427)

Description.—Length ca. 11.5 mm; ITW 2.6 mm. Integument black, with red on part of mandible, orange on part of protibia and distal on foreleg, and middle and hind legs distal to trochanters (excluding spurs); dorsally with bands of setae pale yellow. Clypeus with distinct midline and larger punctures. Mesepisternum lacking erect, simple setae; dorsal half covered with dense, pale, branched setae (sparser on hypoepimeron), ventrally with pale, branched setae on margins, medioventrally mostly asetose, with punctures nearly separated by 0.5 puncture diameter or less; integument between punctures relatively flat. Paramedian bands laterally contiguous with pale setae subapically on scutum. Scutellum strongly bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace subquadrate; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area longitudinally ovate, with dense, fine, silvery setae on basal

half and on lateral margins, enclosing distinct, apicomedial, circular region of sparse, coarse setae; S5 weakly downcurved apically. Male: Unknown.

Comments.—This species strongly resembles *Triepeolus* spp. 95 and 76. It is differentiated from *Triepeolus* sp. 95 by its large size and by the paramedian bands, which are laterally contiguous with pale setae near the anterior end of the scutum. It is differentiated from *Triepeolus* sp. 76 by the only weakly downcurved S5 and by the pseudopygidial area, in which the apicomedial, circular region of coarse setae is fully enclosed by silvery setae. The pseudopygidial area also resembles that of *T. micropygius* (from which it can be differentiated by the only weakly downcurved S5), and *T. atripes* (from which it can be differentiated by the pale yellow bands of setae and red legs).

Distribution.—MEXICO: Coahuila (39 km S Agua Nueva, 24˚53'21"N 101˚04'63"W).

Seasonal Records.—October 20.

Specimens examined.—1 ♀ (CHAMELA).

TRIEPEOLUS SP. 179

(Figs. 428, 429)

Description.—Length ca. 10–11.5 mm; ITW 2.0–2.2 mm. Integument black, with red on part of mandible, orange on labrum, apical clypeus, F1, tegula, and legs (excluding basal coxae and spurs), sometimes on scape, pedicel, and pronotal lobe; dorsally with bands of setae pale yellow. Clypeus distinctly

shining, with vague to distinct midline and distinct larger punctures. Mesepisternum with sparse, erect, simple setae; dorsal third covered with dense, pale, branched setae (absent on hypoepimeron), extending down anterior surface in specimen from Arizona, ventrally mostly asetose (Arizona) or with sparse, brown, branched setae (New Mexico); with punctures nearly contiguous to separated by 0.5 puncture diameter; ventral mesosoma covered with white (Arizona) or brown (New Mexico), branched setae. Paramedian bands distinct. Scutellum weakly bigibbous; axillar spines triangular, reaching midpoint of scutellum. T1 interspace subovate to subrectangular; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female pseudopygidial area subquadrate, with setae nearly uniform, golden setae (setae on basal margin of pseudopygidial area very slightly finer and denser than rest of setae); S5 straight in profile; S2–4 with distinct lateral or continuous bands of white setae (also vaguely present on apical margin of S1). Male: Unknown.

Comments.—This species is similar to *Triepeolus* sp. 65, but *Triepeolus* sp. 179 has distinct paramedian bands, erect, simple setae on the mesepisternum, and the setae of the pseudopygidial area are shorter than those of *Triepeolus* sp. 65 and are directed posteriorly rather than laterally. *Triepeolus* sp. 179 is also similar to *T. medusa* in the sparse, erect setae of the mesepisternum, the setae and punctures of the clypeus and mesepisternum, and the distinct submarginal bands; see comments under *T. medusa* for differentiating characters.

Distribution.—USA: Arizona (Navajo Co.), New Mexico (Sandoval Co.).

Seasonal Records.—August 8 to August 13.

Specimens examined.—2 ♀ (DAVIS, LOGAN).

TRIEPEOLUS SIMPLEX SPECIES GROUP

Species of this group are characterized by the pseudopygidial area, which is concave on the apical margin, and uniquely within *Triepeolus*, in some species the pseudopygidial area has stout setae laterally, near the apical margin. In addition, the female S5 is straight in profile, with bristle-like setae on the apical margin. In most species the clypeus lacks a midline, the mesepisternum lacks erect setae, and the axillar spines are pointed and reach the midpoint of the scutellum. Preliminary evidence suggests that the male pygidial plate lacks a basal transverse ridge, and it is relatively triangular rather than keyhole shaped.

This group will be studied in detail in a forthcoming publication (Rightmyer, in prep.); however, the taxonomic histories of all of the species which can be definitively placed in this group are given below. In addition, some of the more distinctive species are described herein.

TRIEPEOLUS ALVARENGAI MOURE

Triepeolus alvarengai Moure 1955: 126–128 [Holotype: Universidade Federal do Paraná; ♀, Varginha, Minas Gerais, Brazil, February 1954].

Description.—Length ca. 10 mm; ITW 1.9 mm. Integument black, with red to orange on part of mandible, F1, and tegula, reddish brown on lower mesepisternum; dorsally with bands of setae yellow-orange. Clypeus lacking dorsal midline and larger punctures, covered with diffuse pale golden setae. Mesepisternum lacking erect, simple setae; dorsally with dense, pale yellow, branched setae beneath scrobal groove and pronotal lobe; ventrally with small punctures nearly contiguous, covered by diffuse, branched setae (denser in male). Paramedian bands distinct, well separated from anterior margin of scutum (by ca. 3 OD). Scutellum moderately bigibbous; axillar spines strongly pointed, reaching or slightly surpassing scutellar midline. T1 bands of pale setae restricted basolaterally; T2 lacking lateral, longitudinal band of pale setae. Female: Pseudopygidial area triangular, with concave apical margin; S5 straight in profile, with bristle-like setae on apical margin. Male: Pygidial plate subtriangular, apical margin rounded, lacking distinct transverse basal ridge and apical downturned plate; S2–3 with similarly pale golden apical bands of setae.

Comments.—This species is extremely similar to *T. mexicanus*; see comments under that species for differentiating characters.

Distribution.—BRAZIL: Paraná, Minas Gerais.

Seasonal Records.—February (day unspecified) to June (day unspecified).

Specimens examined.—1 ♀, 1 ♂ (CURITIBA).

TRIEPEOLUS KATHRYNAE ROZEN

(Figs. 20, 27, 35, 49, 89, 120, 430, 431)

Triepeolus species B; Rozen 1966: 14–15, Figs. 15–18 [description, illustrations of postdefecating larva].

Triepeolus kathrynae Rozen 1989a: 10–14, Figs. 7, 8, 18–21, 25–32 [Holotype: American Museum of Natural History; ♀, 11 mi. N. Rodeo, Hidalgo Co., New Mexico; August 19 1968]; Rozen 2001: Figs. 7–13 [illustrations of mature larva].

Description.—Length ca. 11–14 mm; ITW 2.2–3.0 mm. Integument black, with red to orange on basal mandible, labrum (sometimes only on margins), and part or entire legs (excluding basal coxae and spurs), often on apical margin of clypeus, orange often on scape, pedicel, and F1, sometimes on most of anterior surface of antennae (held dorsally), sometimes with reddish brown on tegula; dorsally with bands of setae deep yellow. Clypeus lacking midline and larger punctures, mostly covered by diffuse white setae. Mesepisternum lacking erect, simple setae; dorsal half covered with pale yellow, branched setae (usually sparser on hypoepimeron); ventrally covered with sparser brown, branched setae (denser, and sometimes interspersed with white setae in males), with integument shining; punctures nearly contiguous to separated by 0 .5 puncture diameter). Paramedian bands distinct. Scutellum moderately bigibbous; axillar spine extremely long and pointed, reaching or surpassing posterior margin of scutellum, outlined with white setae. T1 interspace subquadrate to subrectangular. T2 with lateral, longitudinal band of pale setae forming acute

angle with apical, transverse band of pale setae. Female: Pseudopygidial area sub-triangular, with apical margin strongly concave, with fine setae directed medially on most of area, laterally with stouter, shorter setae; S5 straight in profile, with bristle-like setae on apical margin. Male: Pygidial plate relatively large, subtriangular, lacking distinct basal transverse ridge and apical plate, but curving posteriorly; S4–5 with golden brown to white apical fringes of setae, and S2–3 with apical bands of white setae (S3 with white setae slightly surpassing apical margin).

Comments: This species is distinctive for its exceedingly long axillar spines that are outlined with white setae, robust body, metasomal banding pattern, and fine, medially-directed setae of the pseudopygidial area. A specimen of this species was identified as "PCAM 2" by D. Yanega.

Distribution.—MEXICO: Chihuahua, Durango, Morelos, Nuevo León; USA: Arizona, New Mexico, Texas.

Host Records.—*Protoxaea gloriosa* (Fox) (1 specimen, investigating burrow, Hidalgo Co, New Mexico; Rozen, 1966, larva from nest; Rozen, 1989a, adult investigating nest entrance).

Floral Records.—*Engelmannia pinnatifida* [= *Engelmannia peristenia* (Raf.) Goodman & Lawson], *Kallstroemia* sp., *Larrea* sp., *Medicago* sp., *Melilotus alba* [= *Melilotus officinalis* (L.) Lam.], *Sphaeralcea* sp.

Seasonal Records.—June 2 to September 28.

Specimens examined.—62 ♀, 37 ♂ (AUSTIN, BERKELEY, LAWRENCE, LOS ANGELES, MEXICO CITY, NEW YORK, RIVERSIDE, TEMPE, TUCSON, URBANA, WASHINGTON D.C.).

TRIEPEOLUS MEXICANUS (CRESSON)

(Figs. 432, 433, 481)

Epeolus mexicanus Cresson 1878: 90 [Lectotype: Academy of Natural Sciences No. 2229; ♀, Mexico]; Cresson 1916: 124 [lectotype designation].

Epeolus rugulosus Cockerell 1917b: 299–300 [Holotype: U. S. National Museum of Natural History No. 22892; ♂, Comacho, Canal Zone, Panama, March 27]. **new synonymy**

Epeolus metatarsalis Friese 1921: 91 [Neotype: American Museum of Natural History; ♀, San Mateo (Alajuela Pr.), Costa Rica; May 1921 (See comments, below)]; Friese 1925a: 31 [description of female]. **new synonymy, new neotype designation**

Triepeolus mexicanus; Cockerell 1949: 461.

Triepeolus bilunatus Cockerell 1949: 461 [Holotype: U. S. National Museum of Natural History No. 58539; ♀, Zamorano (El Paraíso Dept.), Honduras; January 17]. **new synonymy**

Triepeolus rugulosus; Michener 1954: 128.

Description.—Length ca. 7.5–11 mm; ITW 1.6–2.3 mm. Integument black, with red to orange on part of mandible and F1, sometimes on scape, pedicel, and tegula; dorsally with bands of setae orange-yellow to pale yellow. Clypeus lacking or with faint dorsal midline, lacking larger punctures, sometimes covered with diffuse white setae. Mesepisternum lacking erect, simple setae; dorsally with dense, pale yellow, branched setae beneath scrobal groove and

pronotal lobe; ventrally with integument shining, with small punctures separated by up to two or three puncture widths. Pronotal collar uniformly broad dorsally. Paramedian bands absent or represented by denser area of dark brown setae on scutum (rarely represented by scant number white setae). Scutellum moderately bigibbous; axillar spines strongly pointed, reaching or slightly surpassing scutellar midline. T1 bands of pale setae restricted basolaterally; T2 lacking lateral, longitudinal band of pale setae. Female: Pseudopygidial area triangular, with concave apical margin; S5 straight in profile, with bristle-like setae on apical margin. Male: Pygidial plate relatively wide, lacking distinct transverse basal ridge and apical downturned plate; S4–5 with golden apical fringes of setae, contrasting with white apical bands of setae on more basal sterna.

Comments.—This species resembles *T. bilineatus* (and its closely-related species, *T. flavipennsis*), *T. cameroni* (and its closely-related species, *T. rufoclypeus*), and especially *T. alvarengai*, due to the lack of, or highly reduced, apical transverse band of pale setae on the T1. *Triepeolus mexicanus* and *T. alvarengai* are additionally similar in the apically concave pseudopygidial area; however they can be distinguished due to the absence of pale paramedian bands in *T. mexicanus*, contrasted with the presence of these bands in *T. alvarengai*. In addition, the punctures of the scutum are smaller and nearly contiguous in *T. mexicanus*, while in *T. alvarengai* they are larger and more irregular; also, the punctures of the mesepisternum are nearly contiguous in *T. alvarengai*, while in *T. mexicanus* they are separated by up to 2 or 3 puncture diameters. The presence

or absence of pale paramedian bands is very distinctive, but may be weakened by the fact that specimens of *T. atoconganus* have both brown and white paramedian bands. However, the two species names are retained as distinct entities until further specimens of both are made available for study. It remains to be seen if the two species are really as disjunct in distribution as they seem to be based on the available specimens, and if not, if the specimens intergrade in the locales between Panama and Brazil.

Females of *T. bilineatus* and *T. cameroni* are easily distinguished from *T. mexicanus* by the pseudopygidial area, which is apically concave in the latter species. Males of these species are less readily separated, but may be distinguished by the lack of pale paramedian bands in *T. mexicanus*, contrasted with the anteriorly-tapering, pale paramedian bands of *T. bilineatus* and the anteriorly-truncate, pale paramedian bands of *T. cameroni* (but truncate or anteriorly tapering in *T. rufoclypeus*). In addition, in dorsal view, the pale setal area on the pronotal collar is uniformly broad in *T. mexicanus*, in contrast to its often medially or submedially narrowed condition in *T. bilineatus* and *T. cameroni*.

The synonymy of *Epeolus metatarsalis* with *Triepeolus mexicanus* is based on the original, 1921, description of the male, in which Friese mentions yellow setae on the pronotum and sides of the scutum, but mentions neither paramedian bands nor sternal fringes on S4–5. A female specimen in New York (which has an orange Friese "Typus" label, in addition to other labels), is here

designated the neotype despite being the wrong gender (and having wrong collection date), because it is from the type locality, and is what I believe to be the species described in the original description (i.e., it lacks paramedian bands and males of this species have sternal fringes on S4–5). Designation of a neotype is essential in order to stabilize the use of the name. A search for other "type" material of *E. metatarsalis* has revealed only one other possible specimen, a female in Berlin. Friese's subsequent (1925) description of the female (from San José, May, 1922) matches this female specimen (which lacks a "Typus" label); however, it is not being designated as the neotype because, in addition to being the wrong gender (from the original description of the species) and lacking a type label, it is from the wrong locality and is actually a specimen of *T. cameroni* (i.e., it has paramedian bands, and the male of this species has sternal fringes on S3–5 instead of only S4–5). The full label data of the neotype specimen are as follows: "Costa Rica San Mateo 5. 1921 // *Epeolus metatarsalis* Fr. 1921 Friese det. // Typus [orange label] // Am. Mus. Nat. Hist. Dept. Invert. Zool. No. 25583 // Neotype ♀ *Epeolus metatarsalis* Friese 1921 det. Rightmyer 2005."

Distribution.—BELIZE: Cayo; COSTA RICA: Alajuela, Guanacaste; EL SALVADOR: Quezaltepeque; GUATEMALA: El Progreso; HONDURAS: El Paraíso; MEXICO: Jalisco, Morelos, Nayarit, Oaxaca, San Luis Potosí, Sinaloa, Sonora, Tamaulipas, Veracruz; NICARAGUA: Chinandega; PANAMA: Canal Zone; USA: Arizona.

Host Records.—*Melissodes* (*Melissodes*) *tepaneca* Cresson? (1 specimen pinned with host: "Belize, Cayo District, Las Cuevas Research Station, 16Q 288300 1850860, 560 m, May 6 2003, S. K. Javorek; Method: Aerial Net, Habitat: Main Road, Ex: collecting mud").

Floral Records.—*Heliotropium* sp., *Hyptis suaveolens* (L.) Poit., *Ipomoea* sp., *Kallstroemia grandiflora* Torr. ex Gray, *Medicago* sp., *Mimosa* sp., *Prosopis juliflora* (Sw.) DC., *Salix* sp., *Tamarix chinensis* Lour., *Verbesina* sp., cotton (= *Gossypium* sp.), "white flowered legume".

Seasonal Records.—January 12 to November 27.

Specimens examined.—73 ♀, 90 ♂ (BERKELEY, BERLIN, CHAMELA, CORVALLIS, DAVIS, GAINESVILLE, HEREDIA, ITHACA, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, PHILADELPHIA, RIVERSIDE, SAN FRANCISCO, TEMPE, TUCSON, WASHINGTON D.C.).

TRIEPEOLUS OBLITERATUS GRAENICHER

(Figs. 434, 435)

Triepeolus obliteratus Graenicher 1911: 242–243 [Lectotype: Milwaukee Public Museum No. 29595; ♀, Yellow River, Burnett Co., Wisconsin; July 28–31 1909]; Mitchell 1962: 477–478 [redescription]. **new lectotype designation**

Description.—Length ca. 9–11 mm; ITW 1.8–2.1 mm. Integument black, with red on mandibles, usually orange to brownish orange on basal antenna, tegula, and most of legs, sometimes orange on labrum and pronotal lobe; dorsal

aspect with bands of setae pale grey/white bands. Clypeus convex in profile, midline absent, larger punctures absent or weak; covered with sparse, diffuse, white setae. Mesepisternum lacking erect, simple setae, with pale white, branched setae on dorsal third; integument with punctures relatively deeply impressed and nearly contiguous (males), separated by up to 1 puncture diameter in north central specimens or up to 2 puncture diameters in eastern specimens (females). Paramedian bands distinct (females from north central N. A.) or joined on anterior margin to diffuse pale setae (females from eastern Atlantic states and males). Scutellum moderately to strongly bigibbous; axillar spines prominent, triangular, weakly incurved apically, slightly exceeding midpoint of scutellum. T1 interspace widely ovate; T2 with lateral setae forming acute angle with apical transverse band of setae. Female: Pseudopygidial area concave on apical margin, with mostly uniform dark golden reflectance; S5 not downcurved, with bristle-like setae on apical margin; S2–4 with white setae on apical margins. Male: Pygidial plate of moderate size, triangular in shape (rounded apically), lacking distinct basal transverse ridge; S4–5 with brown apical fringes (S4 sometimes with white patch of setae on apicolateral margin); S2–3 with white appressed setae apicolaterally.

Comments.—The original description of this species is based on a female and a male specimen, both designated as "types" by Graenicher. I have selected the female specimen to be the lectotype as females are typically more easily identified in this genus. The label data for the lectotype specimen are as follows:

"Yellow River, Burnett Co. Wis. 09 Jly 28-31 // 29595 // Type [pink label] // Triepeolus obliteratus Graen. ♀ // Lectotype ♀ Triepeolus obliteratus Graenicher des. M. Rightmyer 2005."

In the lectotype and paralectotype of this species the veins separating the second and third submarginal cells are reduced, but other specimens have three complete submarginal cells, suggesting that submarginal wing veins are labile in this species.

This species is similar to *T. rhododontus*, but in *T. obliteratus* the banding is pale grey to white, rather than pale yellow, and the setae of the pseudopygidial area are more uniformly dark brown than in *T. rhododontus*. Males of *T. obliteratus* are also similar to *T. michiganensis*, but *T. obliteratus* lacks the midline on the clypeus, and the apical transverse setae on T1–2 are only slightly interrupted medially (in *T. michiganensis*, the setae are well-separated medially on T1–2, and slightly interrupted medially on T3). Males of *T. obliteratus* also resemble males of *Triepeolus* sp. 101, but can be separated by the pygidial plate, which is very narrow and parallel-sided in *Triepeolus* sp. 101, and wider and more triangular in appearance in *T. obliteratus*, and by the axillar spines, which are somewhat rounded apically and do not reach the scutellar midpoint in *Triepeolus* sp. 101.

Distribution.—CANADA: Saskatchewan; USA: Minnesota, New Jersey, North Carolina, North Dakota, Wisconsin.

Floral Records.—*Grindelia squarrosa* (Pursh) Dunal, *Solidago mollis* Bartl.

Seasonal Records.—July 17 to October 2.

Specimens examined.—9 ♀, 2 ♂ (BERKELEY, ITHACA, LAWRENCE, NEW YORK, WASHINGTON D.C.).

TRIEPEOLUS RHODODONTUS COCKERELL

(Figs. 436, 437)

Triepeolus rhododontus Cockerell 1921: 5–6 [Holotype: American Museum of Natural History No. 25085; ♂, (head of Dry Willow Creek) Wray (Yuma Co.), Colorado; about 40˚ 0'N 102˚ 10'W; 3700 ft; August 17–19 1919].

Triepeolus junctus Mitchell 1962: 471–472, [Holotype: U. S. National Museum of Natural History No. 75243; ♀, Lakeview (Moore Co.), North Carolina; September 23 1933]. **new synonymy**

Description.—Length ca. 9–13 mm; ITW 1.9–2.6 mm. Integument black or dark brown, with orange basal half of mandibles, apically on labrum, tegula, and legs (often with brown areas on at least femur), often with orange scape, pedicel, and F1 (HT antenna entirely brown), and pronotal lobe; dorsal aspect with bands of setae pale yellow. Clypeus lacking midline and either lacking or with weak larger punctures, convex in profile, usually mostly covered with diffuse white setae (both sexes). Mesepisternum lacking or with short (ca. 0.5 OD or less), erect, simple setae, dorsally with band of dense, pale yellow, branched

setae (not on hypoepimeron) and curving somewhat ventrally along posterior margin; ventrally mostly asetose (both sexes); punctures relatively irregular and dense, but separated by up to 1–2 puncture diameters in some areas; integument between relatively flat. Paramedian bands relatively long, distinct (females) or barely contiguous with lateral setae (males). Scutellum strongly bigibbous; axillar spines triangular, reaching or surpassing midpoint of scutellum, apical point weakly incurved, sometimes with reddish tinge. T1 interspace widely rectangular to ovate; T2 with lateral bands forming acute angle with apical transverse band of setae. Female: Pseudopygidial area with apical margin concave, with three distinct regions of setae, including basal region of golden reflecting setae, subapical band of stouter, dark setae, and apical band of finer, silvery reflecting setae (but sometimes entire basal and subapical area covered with gold, stout setae, and apical margin with band of silver setae); S5 not downcurved, entire sternum strongly convex longitudinally; with bristle-like setae on apical margin; S2–4 (sometimes only S3–4) with small bands of white setae on apicolateral margins. Male: Pygidial plate of moderate size, triangular in shape (rounded apically), lacking clear basal transverse ridge; S4–5 with brown apical fringes; S2–3 with white apicolateral bands appressed setae.

Comments.—This species is similar to *T. obliteratus*; see comments under that species for differentiating characters.

Distribution.—MEXICO: Chihuahua; USA: Arizona, Arkansas, Colorado, Kansas, Minnesota, Mississippi, Missouri, New Mexico, New York, North Carolina, South Carolina, South Dakota, Tennessee, Texas, Utah.

Floral Records.—*Acacia angustissima* (P. Mill.) Kuntze, *Helenium* sp., *Helianthus annuus* L., *Heliomeris multiflora* Nutt. var. *nevadensis* (A. Nels.) Yates, *Kallstroemia grandiflora* Torr. ex Gray, *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray.

Seasonal Records.—July 2 to October 13.

Specimens examined.—69 ♀, 9 ♂ (AUSTIN, BERKELEY, BOULDER, DAVIS, GAINESVILLE, LAWRENCE, LOGAN, NEW YORK, RIVERSIDE, SAN FRANCISCO, TUCSON, WASHINGTON D.C.)

TRIEPEOLUS RONI GENARO

(Figs. 438, 439)

Triepeolus roni Genaro 1999: 219–220, Figs. 1c, 2b, 3c [Holotype: Museo Nacional de Historia Natural de Cuba; ♀, Havana, Cuba; December 28 1992]. (not seen; paratype only seen)

Description.—Length ca. 9 mm; ITW 2.0 mm. Integument black, with red to orange basally on mandible, margins of labrum, most of anterior surface of antennae (directed dorsally), tegula, and most of legs (excluding basal coxae and spines, sometimes with brown spots on femora); dorsally with bands of setae pale white (Bahamas) or strongly yellow (Cuba). Clypeus lacking midline, with distinct larger punctures, integument shining, covered with sparse white setae.

Mesepisternum with short, suberect, simple setae; mostly covered with dense, white to pale yellow, branched setae (sparser on hypoepimeron and lacking medioventrally); medioventrally with circular region of sparse, short, black, branched setae; punctures nearly contiguous to separated by 0.5 puncture diameter, integument between punctures shining, raised. Paramedian band distinct, slightly tapering to anterior margin. Scutellum strongly bigibbous; axillar spine pointed, reaching posterior margin of scutellum, apical point curving inward. T1 interspace large, quadrate to rectangular, with basal and apical transverse bands of pale setae interrupted medially, apical bands sublaterally reduced, appearing almost disconnected from lateral bands; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area apical margin concave, with setae suberect, fine, and apically downturned, basal setae differentiated from apical setae by change in plane of integument, and by apical setae becoming finer; with medioapical longitudinal cleft in setae formed by setae directed medially (reminiscent of *Rhogepeolus*); lateral setae especially stout and erect; S5 straight in profile, with bristle-like setae on apical margin. Male: (described by Genaro, 1999).

Comments.—Although the male of this species is known, I did not see any male specimens. Among the Caribbean species, it is distinctive for the rectangular interspace of the T1; among all *Triepeolus* species, it is distinctive for

the medioapical longitudinal cleft formed by the setae on the pseudopygidial area, superficially resembling that of *Rhogepeolus*.

Distribution.—BAHAMAS: Andros Island; CUBA, Havana.

Seasonal Records.—April 6 (Bahamas) and December 28 (Cuba).

Specimens examined.—2 ♀ (LAWRENCE, NEW YORK).

TRIEPEOLUS SIMPLEX ROBERTSON

(Figs. 440, 441)

Triepeolus simplex Robertson 1903: 285 [Lectotype: Illinois Natural History Survey No. 18665; ♀, Carlinville, Macoupin Co., Illinois; July 14 1896]; Mitchell 1962: 483 [redescription]; Webb 1980: 110 [lectotype designation (by W. E. LaBerge)].

Description.—Length ca. 10–13 mm; ITW 2.0–2.5 mm. Integument black, with red medially on mandible, orange on apical scape, entire pedicel, and F1, and sometimes with orange on labrum, apical margin of clypeus, tegula, and distal podites of legs; dorsal aspect with bands of setae yellow (grading to pale yellow posteriorly on metasomal terga). Clypeus lacking midline, lacking or with vague larger punctures, sometimes covered with golden setae (especially males). Mesepisternum lacking erect, simple setae; mostly asetose but with small area of pale, branched setae below scrobal groove and pronotal lobe (both sexes); punctures dense and somewhat irregular, separated by approximately 0.5 puncture diameter. Paramedian bands distinct and usually narrow, curving laterally at anterior margin of scutum (some anterior setae present on scutum in males).

Scutellum strongly bigibbous; axillar spines triangular, reaching midpoint of scutellum, apically pointed and sometimes slightly incurved. T1 interspace subquadrate, rectangular, or triangular; T2 with lateral setae lacking or reduced, forming 90 degree angle with apical setae. Female: Pseudopygidial area with concave apical margin, covered with very short, uniformly golden, somewhat medially-directed setae; S5 not downcurved, with bristle-like setae on apical margin. Mesosoma and metasoma venter entirely dark brown, or rarely S2–3 with diffuse white setae on apicolateral margins. Male: Pygidial plate relatively wide, triangular in shape (apically rounded), lacking or with weak basal transverse ridge; S4 with brown apical fringe; S5 brown apical setae only slightly elongate; S2–3 with white setae laterally.

Comments.—This species occasionally resembles *T. lunatus* in the metasomal banding pattern (particularly the T1 interspace), but can be separated from that species by the pseudopygidial area, which is apically concave in *T. simplex* and slightly convex in *T. lunatus*, and by the apical fringe of setae on the S5 of the males, which is reduced in *T. simplex* and fully present in *T. lunatus*; in addition, the clypeus of *T. simplex* lacks a midline while that of *T. lunatus* generally has a strong midline.

Distribution.—USA: Arkansas, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Minnesota, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Texas.

Host Records.—*Hesperapis* sp.? (1 specimen from Bastrop Co., Texas, "at nest"); *Svastra* (*Epimelissodes*) *petulca* Cresson? (1 specimen from Bastrop Co., Texas, "at nest").

Floral Records.—*Amphiachyris* sp., *Callirhoe involucrata* (Torr. & Gray) Gray, *Chrysopsis camporum* [= *Heterotheca camporum* (Greene) Shinners var. *camporum*], *Cirsium* sp., *Coreopsis* sp., *Dalea candida* Michx. ex Willd., *D. purpurea* Vent., *Eysenhardtia texana* Scheele, *Gaillardia pulchella* Foug., *Helianthus annuus* L., *H. strumosus* L., *H. tuberosus* L., *Pycnanthemum* sp., *Ratibida columnifera* (Nutt.) Woot. & Standl., *R. pinnata* (Vent.) Barnh., *Rudbeckia hirta* L., *R. serotina*, *Silphium speciosum* (= *Silphium integrifolium* Michx. var. *laeve* Torr. & Gray), *Verbena* sp., *Vernonia baldwinii interior* (Small) Faust, *V. missurica* Raf.

Seasonal Records.—March 26 to September 23.

Specimens examined.—97 ♀, 72 ♂ (AUSTIN, BOULDER, CORVALLIS, DAVIS, IOWA CITY, ITHACA, LAWRENCE, LOGAN, LOS ANGELES, NEW YORK, RALEIGH, SAN FRANCISCO, STARKVILLE, URBANA, WASHINGTON D.C.).

Unplaced names within the *T. simplex* species group

The following species names can be definitively assigned to the *T. simplex* species group based on the particular structure of the pseudopygidial area, but are not distinctive enough to be described before completing a thorough study of the

group as a whole. A revision of this and the *T. verbesinae* species groups is forthcoming and the following species will be fully treated in that study.

TRIEPEOLUS LECTIFORMIS COCKERELL

Epeolus lectiformis Cockerell 1925a: 623–624 [Holotype: U. S. National Museum of Natural History No. 40106; ♀, Logan Co., Colorado; August 23 1923].

Triepeolus lectiformis; Brumley 1965: 73.

TRIEPEOLUS SAROTHRINUS COCKERELL

Epeolus sarothrinus Cockerell 1929: 103–104 [Holotype: American Museum of Natural History No. 33583; ♀, Riverside, California; May 26 1928; *Gutierrezia sarothrae*].

Epeolus sarothrinus var. *confluens* Cockerell 1929: 103–104 [Holotype: U. S. National Museum of Natural History No. 54851; ♂, Riverside, California; May 26 1929; *Gutierrezia sarothrae*].

Doeringiella (*Triepeolus*) *sarothrinus*; Vergara & Ayala 2002: 24.

TRIEPEOLUS VERBESINAE SPECIES GROUP

This species group is characterized by the pseudopygidial area, which is distinctly circular, with the setae on the apical margin denser and shorter than those on the main part of the area (Fig. 188a). This group is typically characterized by the lack of a midline on the clypeus, and often by a pronounced posterior, transverse ridge on the scutellum. In addition, species of this group almost never have erect, simple setae on the mesepisternum, and the paramedian bands often taper anteriorly, meeting the anterior margin of the scutum.

Preliminary evidence suggests that males typically have a small, narrow pygidial plate. In North America, this group is usually additionally characterized by the female S5, which is strongly downturned; the axillar spines, which are often rounded apically and do not reach the midpoint of the scutellum; the pale transverse bands of the T1, which are uninterrupted medially; and the lateral longitudinal band of the T2, which forms a strongly acute angle with the pale, apical transverse band (Fig. 489). A notable exception to this characterization of North American species of this group is *T. verbesinae*, which has the bands of pale setae medially interrupted on all terga (Fig. 486). In South America, many species of this group similarly have medially interrupted bands of pale setae on most or all of the metasomal terga.

This group will be studied in detail in a forthcoming publication (Rightmyer, in prep.); however, the taxonomic histories of all of the species which can be definitively placed in this group are given below. In addition, some of the more distinctive species are described herein.

TRIEPEOLUS AGUILARI MOURE

Triepeolus aguilari Moure 1955: 130–132 [Holotype: Universidade Federal do Paraná; ♂, Lima, Peru; January 1949].

Description.—Length ca. 7.5–10 mm; ITW 1.6–1.8 mm. Integument black, with red basally on mandible, orange on pronotal lobe, tegula, and usually most of legs (excluding basal coxae, and sometimes spines, sometimes with dark

spots on femora and tibiae), sometimes with orange on scape, pedicel, and F1; dorsally with bands of setae yellow. Clypeus lacking midline and larger punctures, sometimes obscured by golden or silvery setae. Mesepisternum with short (ca 0.5 OD or less) erect, simple setae, mostly covered with short, pale yellow, branched setae; medioventrally with short, brown, branched setae; punctures nearly contiguous. Paramedian bands tapering to anterior margin of scutum, contiguous laterally with diffuse, pale yellow setae on anterior margin of scutum. Scutellum moderately bigibbous; axillar spines triangular, reaching or almost reaching scutellar midpoint. T1 interspace triangular, with basal and apical transverse bands of pale setae interrupted medially; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area strongly circular; S5 straight in profile. Male: Pygidial plate subtriangular to quadrate, lacking distinct basal transverse ridge and apical downturned plate; S4–5 with pale golden apical fringes of setae; S2–3 with white apical bands of setae.

Comments.—This species is extremely similar to *T. buchwaldi*, differing only in the thickness of the bands of pale setae on the metasoma and (usually) in the overall size. Most of the specimens of *T. aguilari* are males, and in general, males of *Triepeolus* are smaller and more setose. Thus, it may be that *T. aguilari* actually represents the male of *T. buchwaldi*; however, I do have a small, relatively thick-banded female of this species, and a few larger, relatively narrow-banded males of *T. buchwaldi*. It remains to be seen if these specimens represent

anomalies. More specimens from a wider range of localities and collection times may provide stronger evidence for the synonymy of this species with *T. buchwaldi*.

Distribution.—ECUADOR: El Oro, Guayas, Loja; PERU: Lambayeque, Lima.

Seasonal Records.—February 3 to September 9.

Specimens examined.—1 ♀, 6 ♂ (CURITIBA, GAINESVILLE, LAWRENCE, LIMA, LOS ANGELES, URBANA).

TRIEPEOLUS ATOCONGANUS MOURE

(Figs. 442, 443)

Triepeolus atoconganus Moure 1955: 128–130 [Lectotype: Universidade Federal do Paraná No. 1350; ♂, Atocongo, Lima, Peru; August 1948]; Urban 2003: 28 [lectotype designation] (only paralectotype viewed).

Description.—Length ca. 9–14 mm; ITW 2.0–2.7 mm. Integument black, with red to orange on basal mandible, tegula, and parts of legs (excluding basal coxae and spines, sometimes mostly orange except for brown spots on femora and tibiae), usually with orange on scape, pedicel, F1, and pronotal lobe; dorsally with bands of setae pale yellow to yellow. Face with dense, erect setae, especially near antennal sockets, vertex and gena. Mesepisternum with short, sparse, erect, simple setae; dorsally with long, erect, minutely-branched setae, entirely brown to black, or white below scrobal groove and posterior to pronotal lobe; ventrally

with long, black, branched setae sparser, with punctures nearly contiguous to separated by 0.5 puncture diameter, integument between punctures raised. Paramedian bands tapering anteriorly, reaching anterior margin of scutum (discernable but entirely brown in lectotype specimen). Scutellum moderately bigibbous; axillar spines triangular, reaching or barely reaching midline of scutellum. T1 interspace widely ovate; T2 with lateral longitudinal band of pale setae often reduced to small patch, forming weakly acute angle with apical transverse band of pale setae; at least T1–4 with transverse bands of pale setae interrupted medially. Female: circular pseudopygidial area; S5 straight in profile. Male: Pygidial plate subtriangular to quadrate (not emarginate on lateral margin), lacking basal transverse ridge and distinctly differentiated apical downturned plate; S4–5 with apical fringes of setae, S2–3 with white patches of setae apicolaterally, sometimes slightly extended past apical margin on S3.

Comments.—This is the only South American species of the *T. verbesinae* group with erect setae on the face and mesepisternum.

Distribution.—PERU: Ancash, Lima.

Seasonal Records.—August (day unspecified) to September 11, and February 15 to May 14.

Specimens examined.—3 ♀, 6 ♂ (CURITIBA, LAWRENCE, LIMA, NEW YORK).

TRIEPEOLUS BILINEATUS COCKERELL

(Figs. 444, 445)

Triepeolus bilineatus Cockerell 1949: 460–461 [Holotype: U. S. National Museum of Natural History No. 58538; ♀, Zamorano (El Paraíso), Honduras; January 20].

Description.—Length ca. 10–12 mm; ITW 1.9–2.4 mm. Integument black, with red or orange on part of mandible, pedicel, F1, and tegula, often on part of labrum, part or entire pronotal lobe and more or less on legs (except basally on coxae and spurs); dorsally with bands of setae orange-yellow to yellow. Clypeus lacking midline and larger punctures, sometimes covered with diffuse, pale setae. Pronotal collar often narrowed dorsomedially. Mesepisternum lacking erect, simple setae, dorsally with patch dense, branched, pale yellow setae below scrobal groove and on anterior surface below pronotal lobe; ventrally mostly asetose with punctures nearly contiguous to separated by a puncture diameter in some places. Paramedian bands distinct, tapering and curving anteriorly, reaching anterior margin of scutum. Scutellum weakly bigibbous, posteriorly extended into weak transverse ridge; axillar spines triangular, not or barely reaching midpoint of scutellum. T1 bands of pale setae restricted to lateral margin, slightly enlarged basomedially, rarely with reduced apical transverse band pale setae at apicolateral margin (especially in specimens from Texas); T2 lacking lateral, longitudinal band of pale setae. Female: Pseudopygidial area strongly circular, with narrow regions of dense, shining setae along basal and apical margins; S5 only moderately downcurved. Male: Pygidial

plate keyhole shaped, with transverse basal ridge and apical downturned plate; S4–5 with pale golden apical fringes, rest of metasomal sternal setae pale golden, (S3 pale setae slightly surpassing apical margin).

Comments.—This species resembles *T. mexicanus* and *T. cameroni*; see comments under both species for distinguishing characters. *Triepeolus bilineatus* also strongly resembles *T. flavipennsis*; in fact, the two species are likely conspecific. However, I am keeping the names separate due to the lack of female specimens of *T. flavipennsis*, the apparent disjunct distributions of the two species, and because of the differences in the setae of T2–5 (i.e., the apical transverse bands of pale setae are distinctly interrupted medially in *T. flavipennsis*). This latter character is weakened by the fact that some specimens of *T. bilineatus* have slightly interrupted apical transverse bands on T2–3.

Distribution.—GUATEMALA: Alta Verapaz; HONDURAS: El Paraíso, Yoro; MEXICO: Colima, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Querétaro, San Luis Potosí; USA: Texas.

Floral Records.—*Aloysia gratissima* (Gillies & Hook.) Troncoso, *Larrea tridentata* (Sessé & Moc. ex DC.) Coville var. *tridentata*, *Polanisia viscosa* (= *Cleome viscosa* L.), *Prosopis* sp., *Zanthoxylum* sp.

Seasonal Records.—April (day unspecified) to November 23.

Specimens examined.—24 ♀, 26 ♂ (ANN ARBOR, BERKELEY, CHAMELA, CORVALLIS, GAINESVILLE, LAWRENCE, LOGAN, LOS ANGELES, MEXICO CITY, NEW YORK, RIVERSIDE, SAN FRANCISCO, WASHINGTON D.C.).

TRIEPEOLUS BUCHWALDI (FRIESE)

(Figs. 446, 447, 465)

Epeolus buchwaldi Friese 1908: 87–88 [Lectotype: Zoologisches Museum, Humboldt-Universität; ♂, Guayaquil (Guayas), Ecuador; 1901]. **new lectotype designation**

Triepeolus buchwaldi; Cockerell 1913: 372.

Triepeolus megadelphus Cockerell 1914: 314–315 [Holotype: American Museum of Natural History; ♂, Guayaquil (Guayas), Ecuador; May–June 1913]. **new synonymy**

Description.—Length ca. 9–13 mm; ITW 1.9–2.3 mm. Integument black, with red on part or entire mandible, orange on pronotal lobe, tegula, and parts or entire legs (excluding basal coxae and spines, sometimes with brown patches on hind leg), sometimes with orange on scape, pedicel, and F1; dorsally with bands of setae yellow. Clypeus lacking midline and larger punctures, black, roughly punctate, sometimes obscured by golden or silvery setae. Mesepisternum with short (ca 0.5 OD or less) erect, simple setae; dorsally and sometimes ventrally with short, pale yellow, branched setae, especially below scrobal groove and posterior to pronotal lobe; ventrally usually with very sparse, short, black, branched setae; punctures nearly contiguous to separated by 0.5 puncture diameter. Paramedian bands distinct, tapering to anterior margin of scutum.

Scutellum moderately bigibbous; axillar spines triangular, reaching or almost reaching scutellar midpoint. T1 interspace triangular, with basal and apical transverse bands of pale setae interrupted medially; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae (sometimes reduced). Female: Pseudopygidial area strongly circular; S5 straight in profile. Male: Pygidial plate subtriangular, lacking distinct basal transverse ridge and apical downturned plate; S4–5 with pale golden to white apical fringes of setae; S2–3 with white setae on apical margin (slightly surpassing apical margin on S3).

Comments.—This species is extremely similar to *T. aguilari*; see comments under that species.

Moure (1955) suggested that *T. megadelphus* might be synonymous with *T. buchwaldi*, and then confirmed his suspicion in 1957, placing a label on the type specimen of *T. megadelphus* identifying it as a synonym of the other species. However, to my knowledge this synonymy was never formally published.

The original description of *T. buchwaldi* was based on both males and females. In the Berlin Museum, there are two females and one male of this species identified as such by Friese; however, only the male specimen has a type label. This male specimen is therefore designated as the lectotype, and has the following associated label data: "Ecuador Guayaquil 1901 Buchwald // *Epeolus buchwaldi* Fr. ♂ 1907 Friese det. // Type [red label] // Lectotype ♂ *Epeolus buchwaldi* Friese 1908 des. M. Rightmyer 2005."

Distribution.—ECUADOR: El Oro, Guayas, Manabí; PERU: Ancash, Cajamarca, Lambayeque, Lima, Piura.

Host Records.—*Florilegus* (*Florilegus*) *purpurascens* Cockerell (1 specimen pinned with host specimen, apparently taken from nest, from Peru: Cajamarca Prov., 14 km E Tembladera).

Floral Records.—*Bidens* sp., *Gossypium hirsutum* L.

Seasonal Records.—January 5 to September 5.

Specimens examined.—29 ♀, 2 ♂ (BERLIN, GAINESVILLE, LIMA, NEW YORK, WASHINGTON D.C.).

TRIEPEOLUS FLAVIPENNSIS (FRIESE)

Epeolus flavipennsis Friese 1917 [1916]: 337 [Lectotype: Zoologisches Museum, Humboldt-Universität; ♂, Popayán (Cauca), Colombia; 1900]. **new lectotype designation**

Description.—Length ca. 10 mm; ITW 1.7 mm. Integument black to brown, with red to orange on part of mandible, F1, pronotal lobe, tegula, and part of legs; dorsally with bands of setae yellow. Clypeus lacking midline and larger punctures, mostly covered with pale setae. Pronotal collar in dorsal view with pale setae only slightly narrowed medially. Mesepisternum lacking erect setae. Paramedian bands with diffuse, pale setae laterally on anterior margin of scutum. Scutellum weakly bigibbous; axillar spines triangular, nearly reaching midpoint of scutellum. T1 lacking apical transverse band of pale setae, with lateral longitudinal band pale setae slightly expanded basomedially; T2 lacking lateral,

longitudinal band of pale setae. T2–5 with apical transverse bands pale setae medially interrupted. Female: Unknown. Male: Pygidial plate keyhole shaped, with transverse basal ridge and apical downturned plate; S4–5 with pale golden apical fringes of setae; S3 with apical band pale golden setae only slightly surpassing apical margin.

Comments.—The original description of this species was based on two male specimens. In the Berlin Museum, there are two males labeled as types, both with exactly the same label data, except that one specimen has a red "Type" label, while the other has an orange "Typus" label. I here designate the former specimen as the lectotype. The full label data for the lectotype are as follows: "Columbia, Popayan 1900 Lehmann // *Epeolus flavipennsis* Fr. ♂ 1915 Friese det. // Type [red label] // Lectotype ♂ *Epeolus flavipennsis* Friese 1916 des. Rightmyer 2005."

This species is very similar to *T. bilineatus*; see comments under that species.

Distribution.—COLOMBIA: Cauca.

Specimens examined.—2 ♂ (BERLIN).

TRIEPEOLUS OSIRIFORMIS (SCHROTTKY)

(Figs. 92, 126, 448, 449, 466)

Epeolus osiriformis Schrottky 1910: 208–209 [Holotype: Department of Zoology, São Paulo No. 102.272; ♂, Puerto Bertoni (Alto Paraná), Paraguay; April 22 1909; *Vernonia*]. (photographs only viewed)

Epeolus luteipes Friese 1917 [1916]: 297, 336–337 [Lectotype: Zoologisches Museum, Humboldt-Universität; ♀, Villa Rica (Villarrica, Guairá), Paraguay; 1900]; Moure 1955: 125 [synonymy]. **new lectotype designation**

Epeolus paraensis Friese 1925b: 36 [Holotype: Zoologisches Museum, Humboldt-Universität; ♀, Macapá, Pará, Brazil; May 28 1900]; Moure 1955: 125 [synonymy].

Triepeolus nobilis (Friese); Moure 1955: 125; Rightmyer 2004a [misidentification].

Description.—Length ca. 8–11 mm; ITW 1.7–2.5 mm. Integument black, with red on part or entire of: mandible, labrum, and clypeus, almost always on scape, pedicel, F1, pronotum, margins of scutum, tegula, scutellum, axilla, metanotum, and dorsal half of mesepisternum (excluding hypoepimeron), orange on legs (excluding basal coxae), dark reddish brown on ventral metasoma; dorsally with bands of setae yellow to white. Clypeus lacking midline and larger punctures, often covered with diffuse white setae. Mesepisternum lacking erect, simple setae; mostly covered with diffuse, white, branched setae (sparser medioventrally in females). Paramedian bands distinct, tapering to anterior margin. Scutellum weakly bigibbous, posterior surface extended into transverse, shelf-like structure directly above metanotum; axillar spines reaching posterior margin of scutum, sometimes weakly incurved at apical point. T1 interspace widely ovate; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae; all metasomal terga with transverse bands of pale setae very narrow, medially interrupted. Female: Pseudopygidial area strongly circular; S5 straight in profile. Male: Pygidial plate keyhole

shaped, with distinct apical downturned plate but lacking distinct basal transverse ridge; S4–5 with golden apical fringes of setae; S2–3 with apical bands of white setae.

Comments.—Although I did not personally examine the holotype of *Triepeolus osiriformis* (Schrottky), Gabriel Melo kindly provided me with several photographs of it. It is a distinct enough species that these photographs were sufficient to confidently place the species name. This species is easily distinguished by the red integument on much of the head and thorax, especially the scutellum and axillae.

The original description of *T. paraensis* was based on one female specimen; thus a lectotype need not be designated for this species. In contrast, the original description of *T. luteipes* was based on both males and females. In the Berlin Museum, there are two male specimens and one female specimen identified by Friese as *Epeolus luteipes* that bear type labels. I here select the female specimen to be the lectotype; this specimen has the following label data: "Paraguay Villa Rica 1900 // *Epeolus luteipes* Fr. ♀ 1915 Friese det. // Typus [orange label] // Lectotype ♀ *Epeolus luteipes* Friese 1916 des. Rightmyer 2005."

This species has long been known by the name *Triepeolus nobilis*, which is actually a synonymous name of *T. intrepidus*. See further comments under *T. intrepidus*.

Distribution.—ARGENTINA: Buenos Aires (Prov.), Córdoba, La Rioja, Salta, Santa Fe, Tucumán; BRAZIL: Paraná, Santa Catarina, São Paulo; COLOMBIA: Cali; PARAGUAY: Alto Paraná, Guairá; TRINIDAD: Curepe.

Floral Records.—*Vernonia* sp.

Seasonal Records.—July 22 to March 8, and one specimen collected in May (date unspecified).

Specimens examined.—23 ♀, 54 ♂ (GAINESVILLE, BERLIN, ITHACA, LAWRENCE, NEW YORK, SÃO PAULO, WASHINGTON D.C.).

TRIEPEOLUS RUFOTEGULARIS (ASHMEAD)

(Figs. 450, 451)

Epeolus rufotegularis Ashmead 1900: 211 [Holotype: U. S. National Museum of Natural History No. 6397; ♀, St. George's (Leeward side), Grenada, West Indies].

Triepeolus rufotegularis; Cockerell 1938: 154.

Description.—Length ca. 9–10.5 mm; ITW 1.7–2.1 mm. Integument black, with red to orange on part or most of mandible, orange on F1, pronotal lobe, tegula, and legs (excluding basal coxae and spurs), usually on scape and pedicel; dorsally with bands of setae pale yellow to white (shape similar to that of *T. verbesinae*). Clypeus lacking midline and larger punctures, usually covered with diffuse white setae. Mesepisternum lacking erect, simple setae; dorsal half covered with dense, white, branched setae (sparser on hypoepimeron), ventrally covered with diffuse, black , branched setae; punctures nearly contiguous to

separated by 0.5 puncture diameter, integument between punctures shining. Paramedian bands distinct, tapering anteriorly. Scutellum weakly bigibbous; axillar spines triangular, not reaching midpoint of scutellum. T1 interspace widely ovate, T1 sometimes lacking lateral longitudinal band of pale setae, with apical and basal transverse bands of pale setae widely interrupted medially; T2 with lateral, longitudinal band of pale setae absent. Female: Pseudopygidial area strongly circular; S5 weakly downcurved apically. Male: Pygidial plate keyhole shaped, with distinct apical downturned plate and rather indistinct basal transverse ridge; S4–5 with apical fringes of setae golden brown on S5, white on S4; S2–3 with apical bands of white setae.

Comments.—This species is similar to *T. verbesinae* in the pattern of banding on the metasoma, but lacks the strongly downcurved S5 in the female. It is also similar to *Triepeolus* sp. 169, but can be separated from that species by the comparatively short axillar spines.

Distribution.—COLOMBIA: Magdalena; SAINT VINCENT AND THE GRENADINES: Kingstown; GRENADA: St. George's; VENEZUELA: Aragua, Guárico, Zulia.

Seasonal Records.—May 4 to January 13.

Specimens examined.—10 ♀, 1 ♂ (BERKELEY, LAWRENCE-BAKER, LOGAN, WASHINGTON D.C.).

TRIEPEOLUS VERBESINAE (COCKERELL)

(Figs. 452, 453, 467, 486)

Epeolus verbesinae Cockerell 1897: 156–157 [Lectotype: Academy of Natural Sciences; ♂, Deming (Luna Co.), New Mexico]. **new lectotype designation**

Triepeolus verbesinae; Cockerell & Atkins 1902: 44; Linsley 1962: 152, 161 [biological data on sleeping aggregations]; Wcislo & Buchmann 1995: 1023–1024 [description of mating behavior].

Description.—Length ca. 8–11 mm; ITW 1.5–2.5 mm. Integument black, with red on basal mandible, usually on margins of labrum and apical margin of clypeus, rarely on part or entire mesepisternum, orange on pronotal lobe, tegula, and legs (excluding basal coxae and sometimes spurs), often on scape, pedicel and at least F1, sometimes also on rest of flagellomeres; dorsally with bands of setae pale yellow. Clypeus lacking midline and larger punctures, often covered with diffuse white setae. Mesepisternum lacking erect, simple setae; dorsal half covered with dense, white, branched setae, ventrally with sparser, white, branched setae; punctation relatively small, separated by up to 2 puncture diameters in some places. Paramedian bands distinct, narrow, tapering and curving slightly outwards at anterior margin. Scutellum moderately bigibbous; axillar spine triangular, rounded apically, not reaching midpoint of scutellum. T1 interspace somewhat triangular, with apical transverse band of pale setae medially interrupted, strongly widened, bulbous, sublaterally reduced, appearing almost disconnected from lateral band (shape of apical band repeated on all metasomal

terga); T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area strongly circular; S5 strongly downcurved. Male: Pygidial plate weakly keyhole shaped, lacking distinct basal transverse ridge but apically downturned; S4–5 with white to pale golden apical fringes of setae; S2–3 with apical bands of white setae (S3 with white setae slightly surpassing apical margin).

Comments.—This species is extremely abundant in northern Mexico and the western United States, and is well known by many workers due to the distinctive pattern of pale banding on the metasoma. Unlike many of the South American and Caribbean species with similar metasomal banding, this species has a strongly downcurved S5.

This species was described on the basis of 15 male specimens from Deming, New Mexico, and 1 female specimen from Las Cruces, New Mexico. Among all of the material that I examined for this study, only one specimen bears a type label. The label reads "cotype;" thus, presumably there are other specimens with similar labels that I did not find. I here designate the lectotype as this specimen bearing a cotype label, found in the Academy of Natural Sciences in Philadelphia. The label data for the lectotype specimen are as follows: "B48 // *Epeolus verbesinae* Ckll n. sp. Deming, N. M. // Cotype ♂ [red label] // Lectotype ♂ *Epeolus verbesinae* Cockerell 1897 det. Rightmyer 2005."

Distribution.—MEXICO: Baja California; Chihuahua, Sinaloa, Sonora; USA: Arizona, California, New Mexico, Washington.

Host Records.—*Nomia* (*Acunomia*) *tetrazonata tetrazonata* Cockerell (25 specimens, from nest site, Pima Co.; Wcislo, 1993, five prepupae from nests, two of which were reared to adults); *Curvinomia* sp. (3 specimens, from nest, Pima Co., Arizona).

Floral Records.—*Asclepias* sp., *Aster* sp. (= *Symphyotrichum*), *Baccharis glutinosa* [= *Baccharis salicifolia* (Ruiz & Pavón) Pers.], *Cleome jonesi* (= *Cleome lutea* Hook. var. *jonesii* J.F. Macbr.), *Kallstroemia grandiflora* Torr. ex Gray, *Larrea tridentata* (Sessé & Moc. ex DC.) Coville, *Lepidium lasiocarpum* Nutt., *L. thurberi* Woot., *Lippia* sp., *Melilotus alba* [= *Melilotus officinalis* (L.) Lam.], *Pectis papposa* Harvey & Gray, *Polygonum* sp., *Prosopis glandulosa* Torr. var. *glandulosa*, *Salix* sp., *Sapindus saponaria* L. var. *drummondii* (Hook. & Arn.) L. Benson, *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray, "bind weed", "catclaw", cotton (= *Gossypium* sp.).

Seasonal Records.—March 15 to October 10.

Specimens examined.—270 ♀, 328 ♂ (AUSTIN, CORVALLIS, DAVIS, GAINESVILLE, LAWRENCE, LOS ANGELES, NEW YORK, RIVERSIDE, SAN FRANCISCO, TEMPE, TUCSON, WASHINGTON D.C.).

TRIEPEOLUS SP. 101

(Figs. 454, 455)

Description.—Length ca. 8–9 mm; ITW 1.6–1.9 mm. Integument black, orange on basal half of mandible, tegula, and legs, sometimes orange on apical

margin of labrum, outer F1, and pronotal lobe; dorsal aspect with bands of setae very pale yellow, almost white, relatively narrow on metasoma. Clypeus convex in profile, lacking midline and larger punctures, asetose or sparsely covered with white setae (especially males). Mesepisternum lacking erect, simple setae or with sparse, short, erect, simple setae, with punctures nearly contiguous, but separated by up to 1 or 2 puncture diameters in a few places ventrally, these areas somewhat elevated, weakly tuberculate in appearance; with dense, white, branched setae on dorsal third, anterior margin, and anterior surface of mesepisternum, ventrally mostly asetose. Paramedian bands distinct (some females) or joined laterally to diffuse pale setae on anterior margin of scutum (some females and all males). Scutellum moderately bigibbous; axillar spines triangular; sometimes rounded apically, almost reaching or reaching midpoint of scutellum. T1 interspace widely ovate; T2 with lateral bands forming acute angle with apical transverse band of pale setae. Female: Pseudopygidial area strongly circular; S5 strongly downcurved; S2–4 with white apical bands of setae. Male: Pygidial plate narrow, lateral margins nearly parallel-sided, lacking or with weak basal transverse ridge; S3–4 with brown apical fringes (slightly white laterally on S4); S2–3 with white apical bands setae (medially extending past apical margin of S3).

Comments.—Males of this species might be confused with *T. obliteratus*; see comments under that species.

Distribution.—CANADA: Alberta, British Columbia?, Ontario; **USA**: Indiana, Michigan, Minnesota, New Jersey, Wisconsin.

Floral Records.—*Heliopsis* sp., *Solidago* sp.

Seasonal Records.—July 5 to August 27.

Specimens examined.—12 ♀, 3 ♂ (BOULDER, CORVALLIS, LAWRENCE, SAN FRANCISCO, TERRE HAUTE, URBANA, WASHINGTON D.C.).

TRIEPEOLUS SP. 169

(Fig. 456)

Description.—Length ca. 8.5 mm; ITW 2.1 mm. Integument black, with red on part of mandible, apically on labrum, basally and apically on scape, on pedicel and F1, orange on tegula and legs (excluding coxae); dorsally with bands of setae pale yellow. Clypeus lacking midline and larger punctures, covered with diffuse white setae. Mesepisternum lacking erect, simple setae; dorsal half covered with dense, white, branched setae (sparser between hypoepimeron and pronotal lobe); punctures nearly contiguous to separated by 1 puncture diameter in some places. Paramedian bands distinct, short and narrow. Scutellum moderately bigibbous; axillar spines reaching posterior margin of scutellum, pointed and incurved apically. T1 interspace widely ovate; T2 with lateral, longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae; all metasomal terga with transverse bands of pale setae interrupted medially. Female: Unknown. Male: Pygidial plate lacking a distinct basal transverse ridge and apical downturned plate; S4–5 with apical fringes of setae white to pale golden brown; S2–3 with white apical bands of setae.

Comments.—This species is very similar to *T. rufotegularis*, but can be separated from that species by the axillar spines, which are distinctly longer in *Triepeolus* sp. 169 than in *T. rufotegularis*.

Distribution.—VENEZUELA: Lara.

Seasonal Records.—July 11.

Specimens examined.—1 ♂ (GAINESVILLE).

TRIEPEOLUS SP. 172

(Figs. 457, 458)

Description.—Length ca. 11–12 mm; ITW 2.4–2.5 mm. Integument black, with red to orange on part of mandible, F1–3 (on surface facing frons when antennae held dorsally), outer margin of tegula, and legs (excluding coxae, part of trochanters, and spurs); dorsally with bands of setae very pale yellow. Clypeus lacking midline, with faint larger punctures. Mesepisternum apparently lacking erect, simple setae, but upper half covered with dense, long, erect to suberect, white, minutely-branched setae; ventrally with sparser, long, black, erect to suberect setae; punctures nearly contiguous to separated by 1 puncture diameter in some places, integument between punctures raised, tuberculate. Paramedian bands surrounded by long, suberect to erect, white setae covering anterior half and all margins of scutum. Scutellum moderately bigibbous; axillar spines triangular, nearly reaching midpoint of scutellum; both scutellum and axillae diffusely covered with long, white setae. T1 interspace widely ovate; T2 with lateral,

longitudinal band of pale setae forming acute angle with apical, transverse band of pale setae. Female: Pseudopygidial area strongly circular; S5 only moderately downcurved. Male: Unknown.

Comments.—This is the only North American species of the *T. verbesinae* group with long, erect, setae on the mesepisternum. It is also one of the most robust species within this group.

Distribution.—USA: California (Imperial Co., Glamis Dunes).

Seasonal Records.—September 29.

Specimens examined.—2 ♀ (LOGAN).

Unplaced names within the *T. verbesinae* species group

The following species names can be definitively assigned to the *Triepeolus verbesinae* species group, based on the particular structure of the pseudopygidial areas, but are not distinctive enough to be described before completing a thorough study of the group as a whole. A revision of this and the *T. simplex* species groups is forthcoming and the following species will be fully treated in that study.

TRIEPEOLUS ANCORATUS COCKERELL

Triepeolus ancoratus Cockerell 1916a: 63 [Holotype: U. S. National Museum of Natural History No. 100026 (Pomona College No. 155); ♀, Claremont, California].

Triepeolus anchoratus; Moure 1955: 132.

TRIEPEOLUS CALLOPUS COCKERELL

Triepeolus callopus Cockerell 1905: 202–203 [Holotype: U. S. National Museum of Natural History No. 23288; ♀, (Redondo California)].

TRIEPEOLUS CUSTERI COCKERELL

Triepeolus custeri Cockerell 1926b: 306–307 [Holotype: U. S. National Museum of Natural History No. 100025; ♂, (White Rocks, near Boulder), Boulder Co., Colorado; September 18, 1925].

TRIEPEOLUS CYCLURUS COCKERELL

Triepeolus cyclurus Cockerell 1923: 49–50 [Holotype: U. S. National Museum of Natural History No. 100024; ♀, 6 mi E of Wiggins, Colorado; August 15; *Helianthus petiolaris*].

TRIEPEOLUS GRINDELIAE COCKERELL

Triepeolus grindeliae Cockerell 1907a: 51–52 [Holotype: U. S. National Museum of Natural History No. 13670; ♀, Boulder, Colorado; August 7 1906; *Grindelia*].

TRIEPEOLUS HAEMATURUS COCKERELL & SANDHOUSE

Triepeolus haematurus Cockerell & Sandhouse 1924: 311 [Holotype: California Academy of Sciences No. 1604; ♀, Saltair Utah; July 12 1922].

TRIEPEOLUS TIMBERLAKEI COCKERELL

Triepeolus timberlakei Cockerell 1929: 101–102 [Holotype: American Museum of Natural History No. 33583; ♀, Riverside, California; May 29 1928; *Gutierrezia sarothrae*].

TRIEPEOLUS TIMBERLAKEI HETERODOXUS COCKERELL

Triepeolus timberlakei var. *heterodoxus* Cockerell 1929: 101–102 [Holotype: U. S. National Museum of Natural History No. 54850; ♀, Riverside, California; June 28 1928; *Chrysanthemum segetum*].

UNPLACED SPECIES NAMES

The following species names were not associated with a female kind, and were not definitively placeable within the *T. verbesinae* or *T. simplex* species groups. In many cases, these names are based on male holotypes or the type material was missing.

TRIEPEOLUS BIHAMATUS (COCKERELL)

Epeolus bihamatus Cockerell 1907c: 61 [Holotype: U. S. National Museum of Natural History No. 100020; ♂, North Yakima, Washington; June 26 1903]

TRIEPEOLUS BLAISDELLI COCKERELL

Triepeolus blaisdelli Cockerell & Sandhouse 1924: 310–311 [Holotype: California Academy of Sciences No. 1603; ♂, Mokelumne Hill California; September; *Eriogonum*].

TRIEPEOLUS BRUNNESCENS COCKERELL & SANDHOUSE

Triepeolus brunnescens Cockerell & Sandhouse 1924: 313 [Holotype: California Academy of Sciences No. 1606; ♂, Poway, San Diego Co., California; September 10 1884].

TRIEPEOLUS CUNEATUS COCKERELL

Triepeolus cuneatus Cockerell 1917b: 300 [Holotype: U. S. National Museum of Natural History No. 22893; ♂, Meadow Valley (= Rio Piedras Verdes, 9 km S. of S. Colonia García, Chihuahua, according to Labougle, 1990: 50), Mexico].

TRIEPEOLUS HOPKINSI COCKERELL

Triepeolus hopkinsi Cockerell 1905b: 184 [♂; Grand Canyon of the Colorado, Arizona; August 3 1904] [Type lost?].

TRIEPEOLUS INYOENSIS COCKERELL & SANDHOUSE

Triepeolus inyoensis Cockerell & Sandhouse 1924: 309–310 [Holotype: California Academy of Sciences No. 1602; ♂, Pine Creek, Inyo Co. California; 5500 ft; August 15 1914].

TRIEPEOLUS ISOCOMAE COCKERELL

Triepeolus isocomae Cockerell 1904: 38 [Holotype: U. S. National Museum of Natural History No. 9706; ♂, Albuquerque New Mexico; September 16; *Bigelovia* (=*Isocoma*) *wrightii*].

TRIEPEOLUS LUSOR COCKERELL

Triepeolus lusor Cockerell 1925a: 625–626 [Holotype: U. S. National Museum of Natural History No. 100033; ♂, Crook, Colorado; August 24 1920].

TRIEPEOLUS MENSAE COCKERELL

Triepeolus mensae Cockerell 1924: 313–314 [Holotype: California Academy of Sciences No. 1607; ♂, Warner Lake, Lake Co., Oregon; June 21 1922]

TRIEPEOLUS? MERCATUS (FABRICIUS)

Epeolus mercatus Fabricius 1804: 389 [Type lost?]; Cresson 1878: 88 [redescription].

Comments.—*Epeolus mercatus* cannot be confidently assigned to either *Epeolus* or *Triepeolus*, although the original description suggests a species similar to *Triepeolus helianthi*. There does not appear to be any consensus among previous workers as to the identity of this species, as evidenced by numerous, different species identified as *T. mercatus* in the collections examined for this study. See further comments under *Triepeolus remigatus*.

TRIEPEOLUS NEMORALIS (HOLMBERG)

Doeringiella nemoralis Holmberg 1886: 278, 280 [♀, Chaco, Formosa (Argentina), March]. (type not seen; location unknown?)

Triepeolus nemoralis (Holmberg); Roig-Alsina 1989: 578.

Comments.—According to the original description, based on a female specimen from northeastern Argentina, this species is black with a layer of gold hairs; with red on the first three antennal segments, last two metasomal segments, and legs; the T1 has the lateral bands narrowed medially; the T2–4 have gold bands reaching their margins; the T5 is entirely golden; the venter has pale yellow setae at the margins of the segments; all the "sutures" of the mesosoma are covered with dirty white, short, appressed setae; and the "mesonotum" (=scutum) has spots tapering anteriorly.

TRIEPEOLUS OCCIDENTALIS SEGREGATUS COCKERELL

Epeolus occidentalis var. *segregatus* Cockerell 1900: 361–362 [Holotype: U. S. National Museum of Natural History No. 5173? (5172 on specimen); ♂,Las Vegas Hot Springs, New Mexico; July 11].

Triepeolus segregatus (Cockerell); Cockerell 1904: 38–39; Cockerell 1907c: 63 [redescription].

TRIEPEOLUS PERMIXTUS (COCKERELL)

Epeolus permixtus Cockerell 1923b: 94–95 [Holotype: California Academy of Sciences No. 954; ♂, Pond Island Bay, Angel de la Guardia Island, Gulf of California; July 1 1921].

Triepeolus pacis Cockerell 1925b: 201–202 [Holotype: California Academy of Sciences No. 1661; ♂, La Paz, Baja California, Mexico; June 29 1919]. **new synonymy**

TRIEPEOLUS POMONALIS COCKERELL

Tniepeolus (sic) *pomonalis* Cockerell 1916b: 392–393 [Holotype: (supposedly Pomona College No. 160); ♂, Claremont, California] [Type lost?].

Comments.—The holotype of *T. pomonalis* is listed in the original publication as belonging to Pomona College, in Claremont California, but apparently is not presently there (Jonathan Wright, in lit., 2005), nor is it in any of the institutions mentioned in the Acknowledgements and Materials sections. Unfortunately, the identity of this species is not clear based solely on the original description.

TRIEPEOLUS SATURNINUS COCKERELL & SANDHOUSE

Triepeolus saturninus Cockerell & Sandhouse 1924: 312 [Holotype: California Academy of Sciences No. 1605; ♂, Millbrae, (San Mateo Co.), California; September 1 1912].

TRIEPEOLUS SCELESTUS TUBERCULARIS BRUES

Epeolus scelestus tubercularis Brues 1903: 82 [♀; Austin, Texas] [Type lost?].

Comments.—It is likely that *Triepeolus scelestus tubercularis* is synonymous with *Triepeolus scelestus*, but this cannot be confidently assumed based on the description alone.

TRIEPEOLUS SCHWARZI COCKERELL

Triepeolus schwarzi Cockerell 1921: 4–5 [Holotype: American Museum of Natural History No. 25083; ♂, Meeker, Colorado; July (21) 1919; about 40º 2'N 107º 55'W; 6200 ft.*; (Grindelia serrulata*).

TRIEPEOLUS SCHWARZI SUBCALENS COCKERELL & SANDHOUSE

Triepeolus schwarzi subcalens Cockerell & Sandhouse 1924: 309 [Holotype: California Academy of Sciences No. 1601; ♂, Redding California; July 8 1918].

TRIEPEOLUS SEQUIOR COCKERELL

Triepeolus sequior Cockerell 1921: 8–9 [Holotype: American Museum of Natural History No. 25040; ♂, Ridgeway Colorado; July 15 1919].

DISCUSSION

The total number of described and undescribed *Triepeolus* species recognized herein, excluding those in the *T. simplex* and *T. verbesinae* species groups, is 103. An additional 18 species are recognized herein, with an estimated 10 to 15 more yet to be clarified, from the latter two species groups. One hundred sixty-nine species-names have been proposed for *Triepeolus*; of those proposed names, 58 are synonymous, 51 of which are newly synonymized herein (Table 6).

In addition, the following names were either proposed in *Triepeolus*, or were subsequently placed in *Triepeolus*, but are herein confirmed to belong to other genera: *Epeolus scutellaris* Say (correct generic placement), *Epeolus flavofasciatus* Smith and *Triepeolus agaricifer* Cockerell (new synonymy) [= *Epeolus flavofasciatus* (Smith)], *Triepeolus banksi* Cockerell [= *Epeolus banksi* (Cockerell)], *Triepeolus fazi* Cockerell [= *Doeringiella gayi* (Spinola)], *Triepeolus minimus* Robertson [= *Epeolus minimus* (Robertson)], and *Triepeolus pruinosus* Cockerell [= *Doeringiella holmbergi* (Schrottky)]. The taxonomic histories of these names are given in Appendix 5.

In the following discussion of *Triepeolus* diversity, I will include all of the species that have been described herein, including those in the *Triepeolus simplex* and *verbesinae* groups. This discussion excludes those species in the two species groups that have not been fully treated herein; as the *Triepeolus simplex* and *verbesinae* species groups are most diverse in the western United States, the

eventual recognition of more species in these groups is anticipated to strengthen the trends that are noted here.

Triepeolus is most diverse in the southwestern United States and northern Mexico, with 61 species (ca. half of the known species) found in Arizona, Chihuahua, Coahuila, New Mexico, Sonora, and Texas (Appendix 4).

California and Utah also have relatively large numbers of species; with their addition to those six states already tallied, fifteen new species are added to the list, bringing the percentage of the total diversity to approximately 63%. Given the distribution of species in the southwestern United States, it seems odd that Nevada has had so few species recorded; collection efforts should be put into assessing the diversity of *Triepeolus* in that state. California is additionally noteworthy for the large number (seven) of species endemic to that state. In particular, there apparently are a number of endemic species in coastal regions of California, including one (*Triepeolus* sp. 78) restricted to Antioch, an area of isolated sand dunes with other known endemic insects.

The species of *Triepeolus* found in South America are noteworthy for exclusively being members of the *T. simplex* and *verbesinae* groups. This is particularly remarkable considering that species of these groups make up a minority of the species found in the genus as a whole. The species of the Caribbean islands appear to have affinities with the South American fauna, though some distinctive endemics occur there that do not belong to either of those species groups. A phylogeny is needed to help explain these intriguing

biogeographic patterns. Is the relatively depauperate South American fauna the remnants of this genus which subsequently diversified in the north, or is it the result of more recent immigrations?

The known and potential host records for species of *Triepeolus* are presented in Appendix 3. As noted by previous authors, the vast majority of hosts are in the tribe Eucerini, with a possibility of eight genera serving as hosts. Additional tribes within the Apidae include the Anthophorini, Centridini, and Emphorini, although the evidence is weaker for the latter two tribes. *Anthophora* only serves as the host to the species *Triepeolus dacotensis* and *T. mojavensis*. These two species share a fairly unique type of pseudopygidial area, and are robust, vernal bees that lack a distinct preoccipital carina on the gena. The remainder of the apine tribes are host to a wide range of *Triepeolus* species, including those from the *T. simplex* and *verbesinae* groups. *Florilegus* appears to be parasitized only by *T. buchwaldi*, which is a South American member of the *T. verbesinae* group. Similarly, *Syntrichalonia* appears to be parasitized only by *T. intrepidus*; the latter is an unusual species due to the dense, erect golden setae on much of the head and mesosoma. The *Triepeolus* species allied to *T. concavus* (including *T. subnitens* and *T. penicilliferus*) appear to go only to species of *Svastra*.

Table 6. A list of synonymous names in *Triepeolus*. Those marked with an asterisk are newly synonymized.

JUNIOR SYNONYM	VALID NAME
1. *Triepeolus alachuensis* Mitchell*	*Triepeolus rufithorax* Graenicher
2. *Epeolus albopictus* Cockerell*	*Triepeolus aztecus* (Cresson)
3. *Triepeolus alpestris* Cockerell*	*Triepeolus paenepectoralis* Viereck
4. *Triepeolus amandus* Cockerell*	*Triepeolus paenepectoralis* Viereck
5. *Epeolus bardus* Cresson*	*Triepeolus distinctus* (Cresson)
6. *Triepeolus bilunatus* Cockerell*	*Triepeolus mexicanus* (Cresson)
7. *Triepeolus brunneus* Cockerell*	*Triepeolus balteatus* Cockerell
8. *Triepeolus charlottensis* Mitchell*	*Triepeolus brittaini* Cockerell
9. *Triepeolus cirsianus* Mitchell*	*Triepeolus donatus* (Smith)
10. *Triepeolus concinnus* Cockerell*	*Triepeolus townsendi* Cockerell
11. *Triepeolus coquilletti* Cockerell*	*Triepeolus helianthi* (Robertson)
12. *Epeolus costaricensis* Friese*	*Triepeolus aztecus* (Cresson)
13. *Triepeolus dichropus* Cockerell*	*Triepeolus texanus* (Cresson)
14. *Triepeolus digueti* Cockerell*	*Triepeolus intrepidus* (Smith)
15. *Triepeolus eldredi* Cockerell*	*Triepeolus texanus* (Cresson)
16. *Epeolus flavocinctus* Friese*	*Triepeolus aztecus* (Cresson)
17. *Triepeolus floridanus* Mitchell*	*Triepeolus georgicus* Mitchell
18. *Triepeolus fortis* Cockerell*	*Triepeolus martini* (Cockerell)
19. *Triepeolus foxii* Cockerell*	*Triepeolus rufoclypeus* (Fox)
20. *Triepeolus helianthi arizonensis* Cockerell*	*Triepeolus helianthi* (Robertson)
21. *Triepeolus helianthi grandior* Cockerell*	*Triepeolus texanus* (Cresson)
22. *Triepeolus helianthi pacificus* Cockerell*	*Triepeolus helianthi* (Robertson)
23. *Triepeolus insolitus* Cockerell*	*Triepeolus martini* (Cockerell)
24. *Triepeolus junctus* Mitchell*	*Triepeolus rhododontus* Cockerell
25. *Triepeolus lestes* Cockerell*	*Triepeolus subalpinus* Cockerell
26. *Triepeolus lineatulus* Cockerell & Sandhouse*	*Triepeolus helianthi* (Robertson)
27. *Triepeolus loganensis* Cockerell*	*Triepeolus fraserae* Cockerell
28. *Epeolus lunatus concolor* Robertson	*Triepeolus lunatus* (Say)
29. *Epeolus luteipes* Friese	*Triepeolus osiriformis* (Schrottky)
30. *Triepeolus maculiventris* Cockerell*	*Triepeolus helianthi* (Robertson)
31. *Triepeolus megadelphus* Cockerell*	*Triepeolus buchwaldi* (Friese)
32. *Triepeolus mesillae* Cockerell*	*Triepeolus distinctus* (Cresson)
33. *Epeolus metatarsalis* Friese*	*Triepeolus mexicanus* (Cresson)
34. *Triepeolus nautlanus* Cockerell*	*Triepeolus lunatus* (Say)
35. *Epeolus nigriceps* Smith*	*Triepeolus robustus* (Cresson)
36. *Epeolus nobilis* Friese*	*Triepeolus intrepidus* (Smith)
37. *Epeolus oswegoensis* Mitchell*	*Triepeolus pectoralis* (Robertson)
38. *Triepeolus pacis* Cockerell*	*Triepeolus permixtus* (Cockerell)
39. *Triepeolus pallidiventris* Cockerell & Sandhouse*	*Triepeolus texanus* (Cresson)
40. *Epeolus paraensis* Friese	*Triepeolus osiriformis* (Schrottky)
41. *Triepeolus perelegans* Cockerell*	*Triepeolus penicilliferus* (Brues)
42. *Triepeolus pimarum* Cockerell*	*Triepeolus distinctus* (Cresson)
43. *Epeolus piscatoris* Cockerell	*Triepeolus heterurus* (Cockerell)

Table 6, continued.

44. *Triepeolus rectangularis* Cockerell*	*Triepeolus texanus* (Cresson)
45. *Epeolus rugulosus* Cockerell*	*Triepeolus mexicanus* (Cresson)
46. *Triepeolus sandhousae* Cockerell*	*Triepeolus fraserae* Cockerell
47. *Triepeolus signatus* Hedicke*	*Triepeolus ventralis* (Meade-Waldo)
48. *Epeolus speciosus* Gerstaecker	*Triepeolus tristis* (Smith)
49. *Triepeolus stricklandi* Cockerell*	*Triepeolus subalpinus* Cockerell
50. *Epeolus superbus* Provancher*	*Triepeolus remigatus* (Fabricius)
51. *Epeolus texanus nigripes* Cockerell*	*Triepeolus remigatus* (Fabricius)
52. *Triepeolus trichopygus* Cockerell & Timberlake*	*Triepeolus penicilliferus* (Brues)
53. *Triepeolus trilobatus* Cockerell*	*Triepeolus martini* (Cockerell)
54. *Epeolus utahensis* Cockerell*	*Triepeolus heterurus* (Cockerell)
55. *Triepeolus vandykei* Cockerell & Sandhouse*	*Triepeolus paenepectoralis* Viereck
56. *Epeolus virginiensis* Cockerell	*Triepeolus pectoralis* (Robertson)
57. *Triepeolus buscki* Cockerell	*Triepeolus wilsoni* (Cresson)
58. *Triepeolus wyomingensis* Cockerell*	*Triepeolus texanus* (Cresson)

Remarkably, there is some evidence that *Triepeolus* species as a whole utilize hosts from every family of bees. Within Colletidae, species of the matinal genera *Caupolicana* and *Ptiloglossa* appear to serve exclusively as hosts to *T. grandis*. These genera are noteworthy for placing the lining of their cells against the cell wall of their nests, unlike the genus *Colletes*, which leaves a space between the lining and the cell wall. This feature of their cell construction allows the host to put liquid provisions in the cell, yet causes the cell walls to resemble the "varnished" cell surfaces of *Protoxaea* and *Nomia* (Rozen, 1984).

The halictid genera *Dieunomia* and *Nomia* are parasitized by a wide range of *Triepeolus* species. The evidence for hosts within the Melittidae and Megachilidae is not as well established as in the other families. The record of *Triepeolus* sp. 141 near nests of *Atoposmia* is interesting as this is a particularly small sized *Triepeolus*; thus the *Atoposmia* host makes intuitive sense.

Species of the *T. simplex* species group appear to be very diverse in their hosts, with members of that group going to Andrenidae, Apidae, Halictidae, and potentially Melittidae. The halictid record is for *T. distinctus*, and while that species does not have a concave apical margin of the pseudopygidial area, it is likely allied to the *T. simplex* species group as indicated by the presence of bristle-like setae on the female S5. More host data, and a robust phylogeny, are needed for further comparisons with other groups within *Triepeolus*.

A few *Triepeolus* species are recorded as parasitizing species in both the Eucerini and Nomiinae; however, no *Triepeolus* species has been reared from cells of both host families. It is possible that the two hosts were nesting in proximity to each other, and that the *Triepeolus* females were entering nests of hosts that they would not ordinarily use. Confirmation of individual species using multiple host families would be remarkable, due to the obstacles that such a parasite would have to overcome in terms of physically inserting her egg in different cell structures and her young developing on different food resources.

In general, *Triepeolus* species do not appear to be restricted to a particular genus or family of plant for adult nectar visits, with the one possible exception of *T. texanus*, which has been collected only on various species of *Cirsium*. As shown in Table 7, individuals of *Triepeolus* have been collected on 35 plant families; however, the majority of the generic diversity is found in the family Asteraceae. *Triepeolus* has been collected on 67 genera of Asteraceae, or nearly 48% of the total genera recorded in this study. Eighty-two species of *Triepeolus*

recorded herein had associated floral records; of those, 87% were collected on at least one species of Asteraceae. Of the remaining 13%, all except for three species had only one floral record, so it is difficult to determine if the lack of Asteraceae records is due to chance. However, three of those species have at least two records. They are *T. bilineatus*, *T. cameroni*, *T. mexicanus*, and all three are extremely similar in appearance. They are recognizable by the lack of the apical transverse band of pale setae on the T1; however, none is likely to be closely related to any of the other two, as the pseudopygidial area of each is very different (*T. bilineatus* is in the *T. verbesinae* species group, and *T. mexicanus* is in the *T. simplex* species group). These species were collected on a large number of plant families, but all three were collected on Fabaceae and Verbenaceae, and two of them were collected on Zygophyllaceae.

Triepeolus species as a whole are generally found in summer and fall, when eucerines are typically most abundant, and when many composites are in bloom, on which both parasites and hosts are found. However, it is not entirely uncommon to find vernal species of *Triepeolus*. For the North American fauna, there are seven species that begin flying in March, an additional eight in April, and nine in early May. Many of these vernal *Triepeolus* records are from southern or western localities in the United States, and are associated with vernal blooms of Asteraceae. The species of *Triepeolus* that can be found flying early in the year (as well as later, for some species) do not appear to form a group based on morphological features. The hosts of many of these species are still unknown,

but for others (such as *T. mojavensis* and *T. grandis*), the hosts are not eucerines, while in still others (such as *T. simplex* and *T. subnitens*) at least some of the hosts are within the Eucerini. It may be that for at least some *Triepeolus* species, the earlier flight season is correlated with switching to hosts outside of the Eucerini.

Table 7. Flowers visited by *Triepeolus*.

APIACEAE
Petroselinum

APOCYNACEAE
Apocynum

ASCLEPIADACEAE
Asclepias

ASTERACEAE
Acroptilon
Amphiachyris
Aphanostephus
Baccharis
Bahia
Baileya
Barkleyanthus
Bebbia
Bidens
Boltonia
Borrichia
Callistephus
Calyptocarpus
Centaurea
Chloracantha
Chrysopsis
Chrysothamnus
Cichorium
Cirsium
Conoclinium
Coreopsis
Cosmos
Dyssodia
Echinacea
Encelia
Engelmannia
Ericameria
Erigeron
Eupatorium
Euthamia
Gaillardia
Grindelia
Gutierrezia
Gymnosperma
Haplopappus
Helenium

ASTERACEAE CONT.
Helianthella
Helianthus
Heliomeris
Heliopsis
Hemizonia
Heterotheca
Hymenothrix
Inula
Isocoma
Liatris
Lactuca
Lygodesmia
Machaeranthera
Oligoneuron
Palafoxia
Pectis
Pityopsis
Psilostrophe
Ratibida
Rudbeckia
Senecio
Silphium
Simsia
Solidago
Symphyotrichum
Tagetes
Thymophylla
Verbesina
Vernonia
Viguiera
Zinnia

BIGNONIACEAE
Chilopsis

BORAGINACEAE
Cryptantha
Heliotropium
Myosotis

BRASSICACEAE
Lepidium
Sinapis

CACTACEAE
Ferocactus
Opuntia

CAMPANULACEAE
Campanulastrum
Lobelia
Platycodon

CAPPARACEAE
Cleome
Wislizenia

CHENOPODIACEAE
Bassia

CONVOLVULACEAE
Ipomoea

CUCURBITACEAE
Cucumis
Cucurbita

CYRILLACEAE
Cyrilla

EUPHORBIACEAE
Euphorbia
Croton

FABACEAE
Acacia
Dalea
Eysenhardtia
Glycine
Medicago
Melilotus
Mimosa
Parkinsonia
Pomaria
Prosopis
Psorothamnus
Trifolium
Vicia

GENTIANACEAE
Frasera

Table 7, continued.

HYDROPHYLLACEAE
Phacelia

LAMIACEAE
Hyptis
Marrubium
Mentha
Monarda
Monardella
Nepeta
Physostegia
Poliomintha
Pycnanthemum
Salvia

LOASACEAE
Cevallia

LYTHRACEAE
Lythrum

MALVACEAE
Callirhoe
Gossypium
Hibiscus
Sida
Sphaeralcea

ONAGRACEAE
Epilobium

PAPAVERACEAE
Argemone

POLYGONACEAE
Eriogonum
Polygonum

PONTEDERIACEAE
Pontederia

RHAMNACEAE
Ceanothus

RUBIACEAE
Spermacoce
Stenaria

RUTACEAE
Zanthoxylum

SALICACEAE
Salix

SAPINDACEAE
Sapindus

SCROPHULARIACEAE
Veronicastrum

TAMARICACEAE
Tamarix

VERBENACEAE
Aloysia
Lantana
Lippia
Phyla
Verbena

ZYGOPHYLLACEAE
Kallstroemia
Larrea

LITERATURE CITED

Alexander, B. A. 1990. A cladistic analysis of the nomadine bees (Hymenoptera: Apoidea). *Systematic Entomology* 15:121–152.

Alexander, B. A. 1994. Species-groups and cladistic analysis of the cleptoparasitic bee genus *Nomada* (Hymenoptera: Apoidea). *University of Kansas Science Bulletin* 55:175–236.

Alexander, B. A. 1996. Comparative morphology of the female reproductive system of nomadine bees (Hymenoptera: Apidae: Nomadinae). *Memoirs of the Entomological Society of Washington, Contributions on Hymenoptera* 17:14–35.

Arnold, N. 1885. Apum Mohileviensium species parum cognitae vel imperfecte descriptae. *Horae Societatis Entomologicae Rossicae*, *sermonibus in Rossia usitatis editae* 19:282–287.

Ascher, J. S. 2004. *Systematics of the Bee Family Andrenidae* (*Hymenoptera*: *Apoidea*). Doctoral dissertation. Ithaca, NY: Cornell University. ix + 332 pp.

Ashmead, W. H. 1899. Classification of the bees, or the superfamily Apoidea. *Transactions of the American Entomological Society* 26:49–100.

Ashmead, W. H. 1900. Report upon the aculeate Hymenoptera of the Islands of St. Vincent and Grenada, with additions to the parasitic Hymenoptera and a list of the described Hymenoptera of the West Indies. *Transactions of the Entomological Society of London* 33:207–367.

Ayala, R. 1988. Abejas silvestres (Hymenoptera: Apoidea) de Chamela, Jalisco, Mexico. *Folia Entomológica Mexicana* 77:395–493.

Ayala, R. 1999. Revision de las abejas sin aguijon de Mexico (Hymenoptera: Apidae: Meliponini). *Folia Entomológica Mexicana* 106:1–123.

Bischoff, H. 1930. Beitrag zur Kenntnis paläarktischer Arten der Gattung *Epeolus* (Hym. Apid.). *Deutsche Entomologische Zeitschrift* 1930:1–15.

Bohart, G. E. 1966. Notes on *Triepeolus remigatus* (Fabricius), a "cuckoo bee" parasite of the squash bee, *Xenoglossa strenua* (Cresson) (Hymenoptera: Apoidea). *Pan-Pacific Entomologist* 42:255–262.

Bohart, G. E. 1970. *The Evolution of Parasitism Among Bees*. 41st Faculty Honor Lecture. Logan, Utah: Utah State University. ii + 30 pp.

Brues, C. T. 1903. Studies of Texan bees. Part 1. *Entomological News* 14:79–85.

Brumley, R. L. 1965. *A Revision of the Bee Genus* Epeolus *Latreille of Western America North of Mexico*. M.S. thesis. Logan, Utah: Utah State University. iii + 92 pp.

Cameron, P. 1907. Description of a new species of *Epeolus* from Mexico. (Hym.). *Zeitschrift für Systematische Hymenopterologie und Dipterologie* 7:136.

Cane, J. H. 1995. Notes on the nesting biology of *Svastra atripes atrimitra* (LaBerge) (Hymenoptera: Apidae). *Journal of the Kansas Entomological Society* 68:238–240.

Claude-Joseph, F. 1926. Recherches biologiques sur les Hyménoptères du Chili (Mellifères). *Annales des Sciences Naturelles, Zoologie.* Series 10, 9:113–268.

Clement, S. L. 1973. The nesting biology of *Melissodes* (*Eumelissodes*) *rustica* (Say), with a description of the larva (Hymenoptera: Anthophoridae). *Journal of the Kansas Entomological Society* 46:516–525.

Clement, S. L. 1984. Observations on the behavior of *Triepeolus* nr. *eldredi* Cockerell (Hymenoptera: Anthophoridae). *Pan-Pacific Entomologist* 60:300–303.

Cockerell, T.D.A. 1897. New and little-known bees. *Transactions of the American Entomological Society* 24:144–162.

Cockerell, T.D.A. 1898. Tables for the determination of New Mexico bees. *Bulletin of the University of New Mexico* 1:41–73.

Cockerell, T.D.A. 1900. Notes on New Mexico bees. *Canadian Entomologist* 32:361–364.

Cockerell, T.D.A. 1903. Some North American bees: *Osmia* and *Triepeolus*. *Entomological News* 14:331–333.

Cockerell, T.D.A. 1904. Some parasitic bees. *Annals and Magazine of Natural History* (7) 13:33–42.

Cockerell, T.D.A. 1905a. Notes on bees in the British Museum. *Transactions of the American Entomological Society* 31:309–364.

Cockerell, T.D.A. 1905b. Une nouvelle abeille du Mexique. *Bulletin du Muséum d'Histoire Naturelle* 1905:165.

Cockerell, T.D.A. 1905c. The bees of Southern California. *Bulletin of the Southern California Academy of Sciences* 4:99–106.

Cockerell, T.D.A. 1906. The bees of New Mexico. *Transactions of the American Entomological Society* 32:289–314.

Cockerell, T.D.A. 1907a. Two new bees of the genus *Triepeolus*. *Canadian Entomologist* 39:51–52.

Cockerell, T.D.A. 1907b. The bees of Boulder County, Colorado. *University of Colorado Studies* 4:239–259.

Cockerell, T.D.A. 1907c. Descriptions and records of bees.—XV. *Annals and Magazine of Natural History* (7) 20:59–68.

Cockerell, T.D.A. 1907d. New American bees.—III. *Entomologist* 40:135–138.

Cockerell, T.D.A. 1910a. New American bees.—IX. *Entomologist* 43:90–92.

Cockerell, T.D.A. 1910b. Some bees from Eldora, Colorado. *Psyche* 17:244–247.

Cockerell, T.D.A. 1911. Descriptions and records of bees.—XXXIX. *Annals and Magazine of Natural History* (8) 8:660–673.

Cockerell, T.D.A. 1913. Descriptions and records of bees.—LIV. *Annals and Magazine of Natural History* (8) 12:368–376.

Cockerell, T.D.A. 1914. Bees from Ecuador and Peru. *Journal of the New York Entomological Society* 22:306–328.

Cockerell, T.D.A. 1916a. New and little known bees from California. *Pomona Journal of Entomology and Zoology* 8:43–64.

Cockerell, T.D.A. 1916b. Some California bees. *Canadian Entomologist* 48:391–393.

Cockerell, T.D.A. 1917a. Descriptions and records of bees.—LXXV. *Annals and Magazine of Natural History* (8) 19:473–481.

Cockerell, T.D.A. 1917. Descriptions and records of bees.—LXXVII. *Annals and Magazine of Natural History* (8) 20:298–304.

Cockerell, T.D.A. 1919a. Bees in the collection of the United States National Museum.—3. *Proceedings of the United States National Museum* 55:167–221.

Cockerell, T.D.A. 1919b. The bees of Peaceful Valley, Colorado. *Journal of the New York Entomological Society* 27:298–300.

Cockerell, T.D.A. 1921. The epeoline bees of the American Museum Rocky Mountain expeditions. *American Museum Novitates* 23:1–16.

Cockerell, T.D.A. 1925a. Descriptions and records of bees.—CVII. *Annals and Magazine of Natural History* (9) 16:621–629.

Cockerell, T.D.A. 1925b. Bees in the collection of the California Academy of Sciences. *Proceedings of the California Academy of Sciences* 14:185–215.

Cockerell, T.D.A. 1925c. Descriptions and records of bees.—CIV. *Annals and Magazine of Natural History* (9) 15:489–496.

Cockerell, T.D.A. 1928a. Supplementary notes on Colorado bees, with a list of all the genera. *University of Colorado Studies* 16:99–126.

Cockerell, T.D.A. 1928b. Some bees from Utah. *Psyche* 35:232–234.

Cockerell, T.D.A. 1929. Some Californian parasitic bees. *Pan-Pacific Entomologist* 5:101–105.

Cockerell, T.D.A. 1931. Two genera of bees new to the recorded fauna of Nova Scotia. *Canadian Entomologist* 43:279.

Cockerell, T.D.A. 1937. The bees of Alberta.—III. *Canadian Entomologist* 59:86-89.

Cockerell, T.D.A. 1938. Descriptions and records of bees.—CLXIX. *Annals and Magazine of Natural History* (11) 2:146–153.

Cockerell, T.D.A. 1939. The bees of the Southern California Islands. *Proceedings of the California Academy of Sciences* 23:427–436.

Cockerell, T.D.A. 1949. Bees from Central America, principally Honduras. *Proceedings of the United States National Museum* 98:429–490.

Cockerell, T.D.A., and E. Atkins. 1902. Contributions from the New Mexico Biological Station.—XIII. On the bees of the family Nomadidae of Ashmead. *Annals and Magazine of Natural History* (7) 10:40–46.

Cockerell, T.D.A., and G. Sandhouse. 1924. Parasitic bees (Epeolinae and Melectinae) in the collection of the California Academy of Sciences. *Proceedings of the California Academy of Sciences* 13:305–324.

Cockerell, T.D.A., and P. H. Timberlake. 1929. Two new bees of the genus *Triepeolus*. *Pan-Pacific Entomologist* 5:167–169.

Commonwealth Institute of Entomology. 1962. Section 13. Insecta, pp. 1–440, *in* Vevers, H. G. (ed.), *The Zoological Record*. London, England: Zoological Society of London.

Compagnucci, L. A., and A. Roig-Alsina. 2003. Cuatro nuevas especies y análisis filogenético de *Doeringiella* Holmberg sensu stricto (Hymenoptera, Apidae, Epeolini), pp. 123–133, *in* Melo, G.A.R. and Alves dos Santos, I. (eds.), *Apoidea Neotropica*: *Homenagem aos 90 Anos de Jesus Santiago Moure*. Criciúma, Brazil: Editora UNESC.

Cresson, E. T. 1865. Hymenoptera of Cuba. *Proceedings of the Entomological Society of Philadelphia* 4:1–200.

Cresson, E. T. 1878. Descriptions of new North American Hymenoptera in the collection of the American Entomological Society. *Transactions of the American Entomological Society* 7:61–136.

Cresson, E. T. 1916. The Cresson types of Hymenoptera. *Memoires of the American Entomological Society* 1:1–141.

Custer, C. P. 1928. On the nesting habits of *Melissodes* Latr. (Hymenop.). *Canadian Entomologist* 50:28–31.

Dalla Torre, C. G. de. 1896. *Catalogus Hymenopterorum*, Vol. 10, Apidae (Anthophila). Leipzig, Germany: Engelmann viii + 643 pp.

Eardley, C. D. 1991. The genus *Epeolus* Latreille from subsaharan Africa (Hymenoptera: Anthophoridae). *Journal of Natural History* 25:711–731.

Engel, M. S. 2001. A monograph of the Baltic amber bees and evolution of the Apoidea (Hymenoptera). *Bulletin of the American Museum of Natural History* 259:1–192.

Eversmann, E. 1852. Fauna hymenopterologica Volgo-Uralensis. *Bulletin de la Société impériale des Naturalistes de Moscou* 25:1–137.

Fabricius, J. C. 1804. *Systema Piezatorum, secundum Ordines, Genera, Species adiectis Synonymis, Locis, Observationibus, Descriptionibus*. Brunsvigae [Brunswick], Germany: Carolum Reichard. xiv + [15]–[440] + [1]–30 pp.

Fox, W. J. 1891. On a collection of Hymenoptera made in Jamaica during April, 1891. *Transactions of the American Entomological Society* 18:337–348.

Friese, H. 1900. Neue exotische Schmarotzerbienen. *Entomologische Nachrichten* 26:65–67.

Friese, H. 1906. Neue Schmarotzerbienen aus der neotropischen Region. *Zeitschrift für Systematische Hymenopterologie und Dipterologie* 6:118–121.

Friese, H. 1908. Die Apidae (Blumenwespen) von Argentina nach den Reisenergebnissen der Herren A. C. Jensen-Haarup und P. Jörgensen in den Jahren 1904–1907. *Flora og Fauna* 1908:1–111.

Friese, H. 1917[1916]. Zur Bienenfauna von Costa Rica. (Hym.). *Stettiner Entomologische Zeitung* 77:287–339.

Friese, H. 1921. Nachtrag zur Bienenfauna von Costa Rica. *Stettiner Entomologische Zeitung* 82:74–98.

Friese, H. 1925a. Neu neotropische Bienenarten, zugleich II. Nachtrag zur Bienenfauna von Costa Rica. *Stettiner Entomologische Zeitung* 86:1–41.

Friese, H. 1925b. Neu Formen von Schmarotzerbienen, besonders aus paläarktischen Gebiet. *Konowia, Zeitschrift für systematische Insektenkunde* 4:27–42.

Genaro, J. A. 1998. Especie nueva de *Triepeolus* para la República Dominicana (Hymenoptera: Apidae). *Caribbean Journal of Science* 34:92–94.

Genaro, J. A. 1999. Revisión del género *Triepeolus* en Cuba (Hymenoptera: Apidae), con descripción de dos especies nuevas. *Caribbean Journal of Science* 35:215–220.

Genaro, J. A. 2001. Especies nuevas de abejas de Cuba y La Española (Hymenoptera: Colletidae, Megachilidae, Apidae). *Revista de Biología Tropical* 49:1027–1035.

Gerstaecker, A. 1869. Beiträge zur näheren Kenntniss einiger Bienen-Gattungen. *Entomologische Zeitung herausgegeben von dem entomologischen Vereine zu Stettin* 30:139–184.

Gogala, A. 1999. Bee fauna of Slovenia: Checklist of species (Hymenoptera: Apoidea). *Scopolia* 42:1–79.

Goloboff, P. A. 1993. NoName (NONA), version 2.0. Program and documentation. Tucumán, Argentina: Fundación e Instituto Miguel Lillo.

Graenicher, S. 1905. Some observations on the life history and habits of parasitic bees. *Bulletin of the Wisconsin Natural History Society* 3:153–167.

Graenicher, S. 1911. Bees of northwestern Wisconsin. *Bulletin of the Public Museum of the City of Milwaukee* 1:221–249.

Graenicher, S. 1928. New bees from the Miami region of Florida (Hymen.: Andrenidae, Megachilidae). *Entomological News* 39:279–284.

Gribodo, G. 1894. Note imenotterologiche, Nota II, Nuovi generi e nuove specie di Imenotteri antofili ed osservazioni sopra alcune specie già conoscuite. *Bullettino della Società Entomologica Italiana* 26:76–135, 162–314.

Grütte, E. 1935. Zur Abstammung der Kuckucksbienen (Hymenopt. Apid.). *Archiv für Naturgeschichte, Zeitschrift für Systematische Zoologie* 4:449–534.

Handlirsch, A. 1925. Geschichte, Literatur, Technik, Paläontologie, Phylogenie, Systematik. *Handbuch der Entomologie: Band III* (ed. by C. Schröder). Jena, Germany: Gustav Fischer Verlag. viii + 1201 + [1] pp.

Hedicke, H. 1940. Ueber palaarktische Apiden. (Hym.) II. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1939:335-350.

Hicks, C. H. 1926. Nesting habits and parasites of certain bees of Boulder County, Colorado. *University of Colorado Studies* 26:217-252.

Hirashima, Y. 1955. A new species of the genus *Epeolus* Latreille from Japan (Hymenoptera: Apidae). *Insecta Matsumurana* 19:40–43.

Holmberg, E. L. 1886a. Viajes al Tandil y á La Tinta, 2nd Parte, Zoologia, Insectos, I. Himenópteros-Hymenoptera. *Actas de la Academia Nacional de Ciencias de la República Argentina en Córdoba* 5:137–184, 2 pls.

Holmberg, E. L. 1886b. Sobre ápidos Nómadas de la República Argentina. *Anales de la Sociedad Científica Argentina* 22:231–240.

Holmberg, E. L. 1886c. Sobre ápidos Nómadas de la República Argentina. *Anales de la Sociedad Científica Argentina* 22:272–286.

Hurd, P. D., Jr., 1979. Superfamily Apoidea, pp. 1741-2209 *in* K. V. Krombein, P. D. Hurd, Jr., D. R. Smith, and B. D. Burks, eds, *Catalog of Hymenoptera in America North of Mexico*, Vol. 2. Washington, D. C.: Smithsonian Institution Press.

Hurd, P. D., Jr., and E. G. Linsley. 1959. Observations on the nest-site behavior of *Melissodes composita* Tucker and its parasites, with notes on communal use of nest entrances (Hymenoptera: Apoidea). *Entomological News* 70:141–146.

Hurd, P. D., Jr., W. E. LaBerge, and E. G. Linsley. 1980. Principal sunflower bees of North America with an emphasis on the southwestern United States (Hymenoptera: Apoidea). *Smithsonian Contributions to Zoology* 310:i–iv, 1–158.

Labougle, J. M. 1990. *Bombus* of México and Central America (Hymenoptera, Apidae). *University of Kansas Science Bulletin* 54:35–73.

Latreille, P. A. 1802. *Histoire Naturelle des Fourmis, et recueil des Mémoires et d'Observations sur les Abeilles, les Araignées, les Faucheurs, et autres insects*. Paris, France: Crapelet. xvi + 445 pp., 12 pls.

Lepeletier de Saint-Fargeau, A.L.M., and A. Seville. 1825. [Article] in M. Diderot et al., *Encyclopédie Méthodique*. *Histoire Naturelle*. *Entomologie*, *ou Histoire Naturelle des Crustaces*, *des Arachnides et des Insectes*, Vol. 10, P. A. Latreille, ed. Paris, France. 1-344.

Linnaeus, C. 1758. *Systema Naturae per Regna Tria Naturae, secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis [tomus I, editio decima, reformata]*. Holmiae [Stockholm], Sweden: Laurentii Salvii. 824 pp.

Linsley, E. G. 1939. Some new genera and species of epeoline and nomadine bees (Hymenoptera, Nomadidae). *Pan-Pacific Entomologist* 15:1–11.

Linsley, E. G. 1962. Sleeping aggregations of the Aculeate Hymenoptera—II. *Annals of the Entomological Society of America* 55:148–164.

Linsley, E. G., and J. W. McSwain. 1942. The parasites, predators, and inquiline associates of *Anthophora linsleyi*. *American Midland Naturalist* 27:402–417.

Linsley, E. G., and C. D. Michener. 1939. A revision of the North American Nomadidae (Hymenoptera). *Transactions of the American Entomological Society* 65:265–305, pls xv–xviii.

van Lith, J. P. 1956. Notes on *Epeolus* (Hymenoptera Aculeata, Apidae). *Tijdschrift voor Entomologie* 99:31–46.

Lovell, J. H., and T.D.A. Cockerell. 1905. The nomadine and epeoline bees of southern Maine. *Psyche* 12:39-42.

Maeta, Y., N. Kubota, and S. F. Sakagami. 1987. *Nomada japonica* as a thelytokous cleptoparasitic bee, with notes on egg size and egg complement in some cleptoparasitic bees. *Kontyû* 55:21–31.

Maeta, Y., K. Gôukon, N. Sugiura, and R. Miyanaga. 1996. Host records of cleptoparasitic bees in Japan (Hymenoptera, Apoidea). *Japanese Journal of Entomology* 64:830–842.

Mavromoustakis, G. A. 1954. New and interesting bees (Hymenoptera, Apoidea) from Israel. *Bulletin of the Research Council of Israel* 4:256–275.

Mayet, V. 1875. Mémoire sur les moeurs et les métamorphoses d'une nouvelle espèce de Coléoptère de la famille des vésicants le *Sitaris colletis*. *Annales de la Société Entomologique de France*. Series 5, 44:65–92.

Meade-Waldo, G. 1913 Notes on the Apidae (Hymenoptera) in the collection of the British Museum, with descriptions of new species. *Annals and Magazine of Natural History* (8) 12:92–103.

Medler, J. T. 1980 Insects of Nigeria—check list and bibliography. *Memoirs of the American Entomological Institute* 30:1–919.

McGinley, R. J. 1981 Systematics of the Colletidae based on mature larvae with phenetic analysis of apoid larvae. *University of California Publications in Entomology* 91:1–307.

Michener, C. D. 1944. Comparative external morphology, phylogeny, and a classification of the bees (Hymenoptera). *Bulletin of the American Museum of Natural History* 82:151–326.

Michener, C. D. 1953. Comparative morphological and systematic studies of bee larvae with a key to the families of hymenopterous larvae. *University of Kansas Science Bulletin* 35:987–1102.

Michener, C. D. 1954. Bees of Panamá. *Bulletin of the American Museum of Natural History* 104:1–175.

Michener, C. D. 2000. *The Bees of the World*. Baltimore, Maryland: Johns Hopkins University Press. xiv + [1] + 913 pp.

Michener, C. D., and A. Fraser. 1978. A comparative anatomical study of mandibular structure in bees. *University of Kansas Science Bulletin* 51:463–482.

Minckley, R. L., W. T. Wcislo, D. Yanega, and S. L. Buchmann. 1994. Behavior and phenology of a specialist bee (*Dieunomia*) and sunflower (*Helianthus*) pollen availability. *Ecology* 75:1406–1419.

Mitchell, T. B. 1962. Bees of the Eastern United States, Volume II. *North Carolina Agricultural Experiment Station Technical Bulletin* 152: 1–557.

Moure, J. S. 1954. Notas sôbre Epeolini sul-americanos (Hymenopt.-Apoidea). *Dusenia* 5:259–286.

Moure, J. S. 1955. Notas sôbre Epeolini sulamericanos (Hymenopt.-Apoidea). *Dusenia* 6:115–138.

Nielsen, R. A., and G. E. Bohart. 1967. Sex characters of larval bees (Hymenoptera: Apoidea). *Annals of the Entomological Society of America* 60:414–419.

Nixon, K. C. 2002. WinClada, version 1.00.08. Program and documentation. Ithaca, NY: Cornell University.

Packer, L. 2003. Comparative morphology of the skeletal parts of the sting apparatus of bees (Hymenoptera: Apoidea). *Zoological Journal of the Linnean Society* 138:1–38.

Parker, F. D., V. J. Tepedino, and G. E. Bohart. 1981. Notes on the biology of a common sunflower bee, *Melissodes* (*Eumelissodes*) *agilis* Cresson. *Journal of the New York Entomological Society* 89:43–52.

Provancher, L. 1895. Les dernières descriptions de l'Abbé Provancher. Ordre des Hyménoptères. Fam. XXI—Andrenidae. *Naturaliste Canadien* 22:189–191.

Raw, A. 1984. The nesting biology of nine species of Jamaican bees (Hymenoptera). *Revista brasileira de Entomologia* 28:497–506.

Richards, O. W. 1937. A study of the British species of *Epeolus* Latr. and their races, with a key to the species of *Colletes* (Hymen., Apidae). *Transactions of the Society for British Entomology* 4:89–130.

Rightmyer, M. G. 2003. A new species of the bee genus *Rhogepeolus* Moure from Peru Hymenoptera: Apidae). *Journal of the Kansas Entomological Society* 76:290–294.

Rightmyer, M. G. 2004a. Phylogeny and classification of the parasitic bee tribe Epeolini (Hymenoptera: Apidae, Nomadinae). *Scientific Papers, Natural History Museum, The University of Kansas* 33:1–51.

Rightmyer, M. G. 2004b. Redescription of two East Asian species of the tribe Epeolini (Hymenoptera: Apidae; Nomadinae). *Entomological Science* 7:251–262.

Robertson, C. 1897. North American bees—Descriptions and synonyms. *Transactions of the Academy of Science of St. Louis* 7:315–356.

Robertson, C. 1898. New or little known North American bees. *Transactions of the Academy of Science of St. Louis* 7:43-54.

Robertson, C. 1899. Flower visits of oligotropic bees. *Botanical Gazette* 28:215.

Robertson, C. 1901. Some new or little known bees. *Canadian Entomologist* 33:229–231.

Robertson, C. 1902. Some new or little known bees. *Entomological News* 13:79–81.

Robertson, C. 1903. Synopsis of the Epeolinae. *Canadian Entomologist* 35:284–288.

Robertson, C. 1928. *Flowers and Insects*. *Lists of Visitors of Four Hundred and Fifty-Three Flowers*. Lancaster, Pennsylvania: The Science Press Printing Company. 221 pp.

Roig-Alsina, A. 1989. A revision of the bee genus *Doeringiella* (Hymenoptera, Anthophoridae, Nomadinae). *University of Kansas Science Bulletin* 53:576–621.

Roig-Alsina, A. 1991. Cladistic analysis of Nomadinae s. str. with description of a new genus (Hymenoptera: Anthophoridae). *Journal of the Kansas Entomological Society* 64:23–37.

Roig-Alsina, A. 1996. Las especies del género *Rhogepeolus* Moure (Hymenoptera: Apidae: Epeolini). *Neotrópica* 42:55–59.

Roig-Alsina, A. 2003. The bee genus *Doeringiella* Holmberg (Hymenoptera: Apidae): A revision of the subgenus *Pseudepeolus* Holmberg. *Journal of Hymenoptera Research* 12:136–147.

Roig-Alsina, A., and C. D. Michener. 1993. Studies of the phylogeny and classification of long-tongued bees (Hymenoptera: Apoidea). *University of Kansas Science Bulletin* 55:123–162.

Rozen, J. G., Jr. 1964. The biology of *Svastra obliqua obliqua* (Say), with a taxonomic description of its larvae (Apoidea, Anthophoridae). *American Museum Novitates* 2170:1–13.

Rozen, J. G., Jr. 1966. The larvae of the Anthophoridae (Hymenoptera, Apoidea) Part 2. The Nomadinae. *American Museum Novitates* 2244:1–38.

Rozen, J. G., Jr. 1983. Nesting biology of the bee *Svastra sabinensis* (Hymenoptera, Anthophoridae). *Journal of the New York Entomological Society* 91:264–268.

Rozen, J. G., Jr. 1984. Nesting biology of diphaglossine bees (Hymenoptera, Colletidae). *American Museum Novitates* 2786:1–33.

Rozen, J. G., Jr. 1989a Two new species and the redescription of another species of the cleptoparasitic genus *Triepeolus* with notes on their immature stages (Anthophoridae: Nomadinae). *American Museum Novitates* 2956:1–18.

Rozen, J. G., Jr. 1989b. Morphology and systematic significance of first instars of the cleptoparasitic bee tribe Epeolini (Anthophoridae: Nomadinae). *American Museum Novitates* 2957:1–19.

Rozen, J. G., Jr. 1991. Evolution of cleptoparasitism in anthophorid bees as revealed by their mode of parasitism and first instars (Hymenoptera: Apoidea). *American Museum Novitates* 3038:1–15.

Rozen, J. G., Jr. 1996. Phylogenetic analysis of the cleptoparasitic bees belonging to the Nomadinae based on mature larvae (Apoidea: Apidae). *American Museum Novitates* 3180:1–39.

Rozen, J. G., Jr. 1997 New taxa of brachynomadine bees (Apidae: Nomadinae). *American Museum Novitates* 3200:1–42.

Rozen, J. G., Jr. 2001. A taxonomic key to mature larvae of cleptoparasitic bees (Hymenoptera: Apoidea). *American Museum Novitates* 3309:1–27.

Rozen, J. G., Jr. 2003. Eggs, ovariole numbers, and modes of parasitism of cleptoparasitic bees, with emphasis on Neotropical species (Hymenoptera: Apoidea). *American Museum Novitates* 3413:1–36.

Rozen, J. G., Jr., K. R. Eickwort, and G. C. Eickwort. 1978. The bionomics and immature stages of the cleptoparasitic bee genus *Protepeolus* (Anthophoridae, Nomadinae). *American Museum Novitates* 2640:1–24.

Rozen, J. G., Jr., and M. S. Favreau. 1968. Biological notes on *Colletes compactus compactus* and its cuckoo bee, *Epeolus pusillus* (Hymenoptera: Colletidae and Anthophoridae). *Journal of the New York Entomological Society* 76:106–111.

Rozen, J. G., Jr., A. Roig-Alsina, and B. A. Alexander. 1997. The cleptoparasitic bee genus *Rhopalolemma*, with reference to other Nomadinae (Apidae), and biology of its host *Protodufourea* (Halictidae: Rophitinae). *American Museum Novitates* 3194:1–28.

Rust, R. W. 1984. Synonymy in California Channel Island Epeolini bees (Hymenoptera: Anthophoridae). *Pan-Pacific Entomologist* 60:119–121.

Say, T. 1823. A description of some new species of hymenopterous insects. *Western Quarterly Reporter of Medical, Surgical, and Natural Sciences* 2:71–82.

Say, T. 1825. Appendix. Part I.—Natural History. 1. Zoology, pp. 1–104, *in* Keating, W. H., *Narrative of an Expedition to the Source of the St. Peter's River*, *Lake Winnepeek*, *Lake of the Woods*, *&c*. *Performed in the Year 1823*, *by order of the Hon*. *J*. *C*. *Calhoun*, *Secretary of War*, *Under the Command of Stephen H*. *Long*, *U*. *S*. *T*. *E*., Volume 2. London, England: Cox and Baylis.

Schrottky, C. 1902. Ensaio sobre as abelhas solitarias do Brazil. *Revista do Museo Paulista* 5:330–613, pls xii–xiv.

Schrottky, C. 1910. Two new Nomadidae (Hymenoptera) from South America. *Journal of the New York Entomological Society* 18:208–210.

Schrottky, C. 1913. La distributión geográfica de los himenópteros Argentinos. *Annales de la Sociedad Cientifica Argentina* 75:115–286.

Scudder, G. G. E. 1961. The comparative morphology of the insect ovipositor. *Transactions of the Royal Entomological Society of London* 113:2–40.

Scudder, G. G. E. 1964. Further problems in the interpretation and homology of the insect ovipositor. *Canadian Entomologist* 96:405–417.

Scudder, G. G. E. 1971. Comparative morphology of insect genitalia. *Annual Review of Entomology* 16:379–406.

Smith, F. 1854. *Catalogue of Hymenopterous Insects in the Collection of the British Museum*, *Part 2*. London, England: British Museum. pp. 199–465, pls. vii–xii.

Smith, F. 1879. *Descriptions of New Species of Hymenoptera in the Collection of the British Museum*. London, England: British Museum. xxi + 240 pp.

Snelling, R. R. 1986. Contributions toward a revision of the New World nomadine bees. A partitioning of the genus *Nomada* (Hymenoptera: Anthophoridae). *Contributions in Science, Natural History Museum of Los Angeles County* 376:1–32.

Snodgrass, R. E. 1956. *Anatomy of the Honey Bee*. Ithaca, NY: Cornell University Press. xiv + [2] + 334 pp.

Spinola, M. 1851. Himenopteros, pp. 153-569 *in* C. Gay, *Historia Fisica y Politica de Chile Segun Documentos Adquiridos en esta Republica Durante Doce Años de Residencia en Ella y Publicada Bajo los Auspicios del Supremo Gobierno. Zoologia*, Vol. 6. Paris, France: Casa del autor.

Stevens, O. A. 1919. The panurgine bees of North Dakota and a new *Epeolus*. (Hym.). Canadian Entomologist 51:205–210.

Sturm, H., and R. Machida. 2001. *Handbuch der Zoologie*; *Band 4*. *Arthropoda*: *Insecta, Teilband 37*: *Archaeognatha*. Berlin, Germany: Walter de Gruyter. vii + 213 pp.

Tadauchi, O., and M. Schwarz. 1999. A new species of the genus *Epeolus* from Japan (Hymenoptera, Anthophoridae). Esakia 39:47–51.

Torchio, P. F. 1986. Late embryogenesis and egg eclosion in *Triepeolus* and *Anthophora* with a prospectus of nomadine classification (Hymenoptera: Anthophoridae). Annals of the Entomological Society of America 79:588–596.

Torchio, P. F., and D. J. Burdick. 1988. Comparative notes on the biology and development of *Epeolus compactus* Cresson, a cleptoparasite of *Colletes kincaidii* Cockerell (Hymenoptera: Anthophoridae, Colletidae). Annals of the Entomological Society of America 81:626–636.

Viereck, H. L. 1905. Synopsis of bees of Oregon, Washington, British Columbia and Vancouver.—IV. Canadian Entomologist 37:277–287.

Urban, D. 2003. Catálogo das abelhas publicadas por Jesus Santiago Moure, pp. 11–43, *in* Melo, G.A.R. and Alves dos Santos, I. (eds.), *Apoidea Neotropica*: *Homenagem aos 90 Anos de Jesus Santiago Moure*. Criciúma, Brazil: Editora UNESC.

Wcislo, W. T. 1993. Communal nesting in a North American pearly-banded bee, *Nomia tetrazonata*, with notes on nesting behavior of *Dieunomia heteropoda* (Hymenoptera: Halictidae: Nomiinae). Annals of the Entomological Society of America 86:813–821.

Warncke, K. 1982. Zur Systematik der Bienen—Die Unterfamilie Nomadinae (Hymenoptera, Apidae). Entomofauna. Zeitschrift für Entomologie 3:97–126.

Wcislo, W. T., and S. L. Buchmann. 1995. Mating behaviour in the bees, *Dieunomia heteropoda* and *Nomia tetrazonata*, with a review of courtship in Nomiinae (Hymenoptera: Halictidae). Journal of Natural History 29:1015–1027.

Wcislo, W. T., and J. H. Cane. 1996. Floral resource utilization by solitary bees (Hymenoptera: Apoidea) and exploitation of their stored foods by natural enemies. Annual Review of Entomology 41:257–286.

Wcislo, W. T., R. L. Minckley, R.A.B. Leschen, and S. Reyes. 1994. Rates of parasitism by natural enemies of a solitary bee, *Dieunomia triangulifera*

(Hymenoptera, Coleoptera and Diptera) in relation to phenologies. Sociobiology 23:265–273.

Webb, D. W. 1980. Primary insect types in the Illinois Natural History Survey Collection, exclusive of the Collembola and Thysanoptera. Illinois Natural History Survey Bulletin 32:51–191.

Westrich, P. 1989. *Die Wildbienen Baden-Württembergs*: *Allgemeiner Teil*. Stuttgart, Germany: Eugene Ulmer. 431 pp.

Wuellner, C. T., and M. S. Hixon. 1999. Behavior of a cleptoparasitic bee, *Triepeolus distinctus* (Hymenoptera: Nomadinae), before departing from the nest of its host, *Dieunomia triangulifera* (Hymenoptera: Halictidae). University of Kansas Natural History Museum Special Publication 24:143–150.

Yasumatsu, K. 1933. Die Schmuckbienen (*Epeolus*) Japans (Hymenoptera, Melectidae). Transactions of the Kansai Entomological Society 4:1–6, 3 pls.

Yasumatsu, K. 1938. Schmuckbienen (*Epeolus*) der mandschurischen Subregion (Hymenoptera, Apoidea). Transactions of the Sapporo Natural History Society 15:223–226.

Zimsen, E. 1964. *The Type Material of I. C. Fabricius*. Copenhagen, Denmark: Munksgaard. 445 pp.

Appendix 1. Characters used in the cladistic analysis. Character-state zero is not necessarily plesiomorphic.

Head.

1. *Galea*: (0) weakly sclerotized, flexible, with apex pointed or narrowly rounded; (1) strongly sclerotized, stiff, with apex broadly rounded.

2. *Maxillary palpal segment number*: (0) 1 (Fig. 29); (1) 2, the distal segment small and ovate (Fig. 28); (2) 2; the distal segment elongate (Fig. 27); (3) 3 segments (Fig. 26); (4) 5 segments (Fig. 25); (5) 6 segments (Figs. 23 and 24). I have coded two palpal segments (distal segment elongate) as a character-state separate from two palpal segments (distal segment small and ovate) because I have found no gradations between the two. Some individuals (e.g., *Rhogepeolus bigibbosus*) were polymorphic with two palpal segments (the distal segment elongate) in one palpus and three palpal segments in the other, leading me to suspect that the elongate segment may result from the fusion of two smaller segments. No specimens were polymorphic for two segments with the distal segment small on one palpus and elongate in the other.

3. *Mandibular articulations*: (0) both in contact with compound eye; (1) only posterior articulation in contact with eye.

4. *Labrum with two submedian apical or subapical tubercles* (Figs. 34, 35, and 37): (0) absent; (1) present.

5. *Labrum with apical margin*: (0) straight or approximately continuous with slope of lateral labral margin (Fig. 35); (1) concave between apical tubercles (Fig. 34); (2) forming a process, this process sometimes minute (Fig. 37); (3) elevated, continuous with elongate apical tubercles (Fig. 36).

6. *Mandible with distinct preapical tooth*: (0) absent (Fig. 40); (1) formed of trimmal extension, such that tooth is relatively medial on mandible and directed towards inner surface (Fig. 39). The preapical tooth found in *Biastes brevicornis* was not considered homologous to those found in some Epeolini (i.e., character-state 1) because it is formed at the terminus of the acetabular carina, such that the tooth

is relatively apical on the mandible and directed apically, as opposed to being an extension of the trimma. Thus, *B. brevicornis* was coded as having character-state 0.

7. *Frontal line*: (0) weakly carinate (Fig. 168); (1) strongly carinate (Fig. 167).

8. *Supraclypeal area*: (0) flat, not noticeably produced above plane of face; (1) produced, receding evenly from frontal carina to subantennal sutures (Fig. 166); (2) produced into roughly pentagonal-shaped swelling; (3) forming bulbous protrusion between antennal sockets (Fig. 168); (4) forming bulbous protrusion with lateral processes (Fig. 169).

9. *Clypeus with faint carina extending from end of frontal line*: (0) absent; (1) present.

10. *Lateroclypeal carina of males*: (0) absent; (1) present, well-separated from compound eyes (Fig. 40); (2) present, forming almost continuous carina with paraocular carina (Fig. 39). Roig-Alsina (1991) noted that the presence of the lateroclypeal carina is variable within male *Nomada*; in *Nomada pampicola* the carina is absent.

11. *Longest length of female F1/F2*: (0) less than or equal to 0.75; (1) about 1; (2) greater than or equal to 1.25.

12. *Antennal pedicel of males*: (0) set into apex of scape, exposed part of pedicel thus 1.5 or more times as broad as long; (1) more fully exposed, only slightly broader than long or as broad as long.

13. *Scape length/width, excluding basal bulb*: (0) less than 1.5; (1) 1.5–1.7; (2) 1.8–2.0; (3) greater than 2.0. Only females were coded for species of *Doeringiella* whose males have swollen scapes.

14. *Female scape with sub-basal angle on plical surface*: (0) absent; (1) present. As defined in Roig-Alsina (1989), the plical surface is the surface of the scape toward which the flagellum is flexed.

15. *Frons with prominent depression behind scape*: (0) absent; (1) present (Fig. 167). I have coded *Rho. emarginatus* as lacking this character; the deep pit found on the frons of this species is not homologous to the more evenly concave areas present in *Doeringiella* and *Thalestria*.

16. *Paraocular carina*: (0) absent (Fig. 40); (1) present (Fig. 39).

17. *Compound eyes of males*: (0) converging below (Fig. 167); (1) parallel (Fig. 166).

18. *Interocellar distance/width of lateral ocellus* (*approximate*): (0) 1.0; (1) 1.5–2.0; (2) 2.5.

19. *Glabrous lobe between compound eye and lateral ocellus*: (0) absent; (1) present, shining and relatively flat; (2) present, enlarged and not shining, waxy in appearance (Fig. 42).

20. *Gena with swollen protrusion on dorsal area*: (0) absent; (1) present, not pronounced (Fig. 41); (2) present, pronounced (Fig. 42).

21. *Preoccipital carina*: (0) absent; (1) continuous, forming a smoothly rounded curve (Fig. 30); (2) continuous, forming angles at the upper corners of head (Fig. 31); (3) discontinuous, present only on gena and dorsal edge of head behind vertex (Fig. 32); (4) on gena only (Fig. 33).

Mesosoma.

22. *Pronotum with dorsal, anterior margin*: (0) straight or nearly so (Fig. 44); (1) convex (Fig. 45).

23. *Pronotum with dorsal, posterior surface, at midline of scutal margin in dorsal view*: (0) not visible, scutum overhanging pronotum at midline (Fig. 43); (1) visible, length much less than 1 OD (Fig. 44); (2) visible, length approximately equal to 1 OD (Fig. 45).

24. *Pronotum with dorsal, posterior surface, in lateral view*: (0) near plane of dorsal surface of scutum, continuous with curve of scutum (Fig. 50); (1) below plane of dorsal surface of scutum (Fig. 49); (2) greatly below plane of dorsal surface of scutum, anterior part of scutum arching above pronotum (Fig. 48).

25. *Scutum with longitudinal band of appressed setae on midline*: (0) absent; (1) present.

26. *Scutum with submedian longitudinal bands of appressed setae on anterior half*: (0) absent; (1) present as two short bands on anterior end of scutum, with bands sometimes reduced to dots; (2) present as two long bands extending to middle of scutum.

27. *Scutellum with two convexities*: (0) absent; (1) present, weak; (2) present, pronounced.

28. *Scutellum with carinate or flattened projections overhanging posterior surface of scutellum*: (0) absent; (1) present. Character-state 1 is considerably more pronounced in *Epeolus variolosus* than in *Epeolus bifasciatus*.

29. *Scutellum with two mammiform tubercles*: (0) absent; (1) present, weak; (2) present, enlarged.

30. *Scutellum with color sexual dimorphism*: (0) absent; (1) present, with female scutellum red, male black.

31. *Scutellum with distinct median longitudinal strip of appressed setae*: (0) absent; (1) present.

32. *Axillar spines*: (0) absent; (1) present.

33. *Axillar spines with pronounced carinate ridge*: (0) absent; (1) present, defining dorsal edge (Fig. 46); (2) present, defining lateral edge (Fig. 47). Several other species of *Epeolus* that were examined (e.g. *Epeolus cruciger*, *Epeolus lectoides*, and others) appear to have a similar but much weaker carina on the axilla.

34. *Forewing setae on radial cell*: (0) dense on entire or majority of cell; (1) restricted to costal half or less of cell (along Sc+R); (2) sparse, scattered.

35. *Pterostigma length/ prestigma length* (*about*): (0) 1.5 (Fig. 52); (1) 3 (Fig. 53); (2) 5 (Fig. 51).

36. *Forewing vein r-rs*: (0) arising from point distal to midpoint of pterostigma (Figs. 52 and 53); (1) arising from midpoint of pterostigma (Fig. 51).

37. *Length of all submarginal cells together*: (0) distinctly greater than length of marginal cell (Figs. 52–63); (1) approximately equal to length of marginal cell (Fig. 51).

38. *Vein 2rs-m*: (0) extending to, or slightly distal to, midpoint of marginal cell (Figs. 52 and 53); (1) basal to midpoint of marginal cell (Fig. 51).

39. *Forewing with papilliform setae distal to cells*: (0) absent; (1) present.

40. *Hind wing with second abscissa of vein M+Cu*: (0) at least twice as long as cu-a, usually as long as or longer than M; (1) less than twice as long as cu-a, approximately one-half to three-fourths as long as M; (2) less than twice as long as cu-a, much less than half as long as M.

41. *Procoxa shape*: (0) roughly conical or pyriform, with trochanters close together; (1) roughly quadrate, with trochanters widely separated. The procoxa is somewhat less quadrate in *Rhogepeolus* s.l. and some *Epeolus* than in other Epeolini.

42. *Male mesofemur with long setae on undersurface*: (0) absent; (1) present.

43. *Mesotibia with dense patch of golden, simple setae on anterior margin of outer surface*: (0) absent; (1) present (Fig. 172).

44. *Mesotibia with thick, spine-like setae on posterior-facing surface*: (0) absent; (1) few, scattered; (2) numerous.

45. *Female metatibia with apical, posterolateral surface*: (0) bearing setae similar to rest of lateral surface of metatibia; (1) less setose than rest of metatibia, but bearing spines (Fig. 173); (2) bearing dense patch of simple setae, with light reflecting from these setae differently (e.g., silvery or golden brown) than from surrounding setae (similar to that shown in Figs. 170 and 171).

46. *Metatibia with differentiated bases of spine-like setae*: (0) absent; (1) present, not enlarged; (2) present, dorsally enlarged (Fig. 174).

47. *Basitibial plate*: (0) absent or lacking distinct boundary; (1) not fully bordered by carina; (2) fully bordered by carina.

Metasoma.

48. *Metasoma with appressed setae*: (0) absent; (1) restricted to small spots on terga; (2) forming bands across terga.

49. *Female T5 with branched setae*: (0) absent; (1) present at least lateral to pseudopygidial area.

50. *Pseudopygidial area with apical margin*: (0) convex; (1) straight or nearly so; (2) concave.

51. *Pseudopygidial area with medioapical slit*: (0) absent; (1) present (Figs. 179A and 181).

52. *Pseudopygidial area with silvery band*: (0) absent; (1) present, formed of rounded, flattened setae (Figs. 190 and 191); (2) present, formed of pointed, flattened setae (Fig. 189C).

53. *Pseudopygidial area with globular, deeply rugoso-striate setae*: (0) absent; (1) present (Fig. 180B).

54. *Pseudopygidial area with entirely tubular, apically blunt setae*: (0) absent; (1) present (Fig. 179B).

55. *Pseudopygidial area primarily with basally tubular, apically spatulate but pointed setae*: (0) absent; (1) present (Figs. 185B, 188B).

56. *Female pygidial plate with longitudinal median ridge*: (0) absent; (1) present.

57. *Female pygidial plate with apical ventral surface, in posterior view*: (0) with no obvious areas of thickening; (1) medially forming one rounded process, this process apparently derived from ventral surface of T5 (Fig. 175); (2) medially forming two flattened rounded processes, these processes apparently derived from ventral surface of T5 (Fig. 176; processes sometimes very reduced); (3)

mediolaterally thickened into two triangular projections, these processes apparently derived from ventral surface of T5 (Fig. 177); (4) laterally forming enlarged triangular processes, these processes apparently derived from both ventral and lateral surfaces of T5; (5) laterally forming scroll-like processes, these processes apparently derived from lateral surface of T5 (Fig. 178).

58. *Male pygidial plate with distal surface*: (0) not distinctly differentiated from dorsal surface of plate; (1) facing posteriorly, distinct from dorsal surface of plate (Fig. 19).

59. *Female T7 with lateral process* (*articulates with S6*): (0) not elongate (Figs. 152–161, 164, and 165; (1) elongate (Fig. 163); (2) extremely elongate (Fig. 162).

60. *Female T7 with lateral margin*: (0) not emarginate (Figs. 152–157, 160–165); (1) emarginate (Figs. 158 and 159). The emargination is created by the extension of the lateral and posterior lamellae.

61. *Female T7 with apodemal region*: (0) forming an angle of roughly 45 degrees (Figs. 152–155, 157–159); (1) forming a right angle (Figs. 156, 160–165).

62. *Female T8 with cross bar extending from anterior ridge*: (0) absent (Figs. 147–149); (1) present, distinctly sclerotized (Figs. 150 and 151).

63. *Male S3 with setae at apex*: (0) not elongate, straight (or absent); (1) distinctly longer than those on apex of S2, straight; (2) distinctly longer than those on apex of S2, curved. There is the possibility that this character is developmentally linked with characters 64 and 65; however, they have been coded separately due to the fact that they vary independently.

64. *Male S4 with setae at apex*: (0) not elongate, straight (or absent); (1) distinctly longer than those on apex of S2, curved.

65. *Male S5 with setae at apex*: (0) not elongate, straight (or absent); (1) distinctly longer than those on apex of S2, straight; (2) distinctly longer than those on apex of S2, curved.

66. *Female S5*: (0) truncate or broadly rounded, with medioapical margin slightly or dramatically emarginate (except in *Brachynomada*, which has an autapomorphic medioapical projection); (1) elongate, with broadly trough-shaped with medioapical margin convex or forming posterior median point.

67. *Female S5 with apical margin*: (0) roughly in same plane as disk of S5; (1) forming ventrally directed lip.

68. *Female S6 with sclerotized area of disk*: (0) long, equal to or longer than processes (Figs. 2, 3, 5, 11–13); (1) reduced, much shorter than processes (except in *Biastes* where processes are not elongate; Figs. 4, 7, 9, 10).

69. *Female S6 with inner, apical margin between processes*: (0) convex (Fig. 13); (1) evenly concave or V-shaped (Figs. 11 and 12); (2) concave medially, with slight lateral convexity (i.e., sinuous; Fig. 7); (3) medially forming a straight line roughly perpendicular to inner margins of processes (Figs. 9 and 10).

70. *Female S6 with principal setae*: (0) absent (Fig.5); (1) stout, rounded to bluntly pointed (Figs. 11 and 12); (2) forming conical denticles (Fig. 13); (3) elongate, pointed, hooked (Figs. 7 and 10).

71. *Female S6 with principal setae directed*: (0) medioventrally to ventrally (Fig. 13); (1) laterally (Figs. 7 and 10–12).

72. *Female S6 with marginal setae*: (0) present along entire margin (Figs. 11–13); (1) absent on medial margin between apical lateral processes (Figs. 7, 9, and 10).

73. *Female S6 with apical margin of processes*: (0) not forming flat, apical plate (Fig. 13); (1) forming small, rounded, flat, apical plate (Figs. 11 and 12); (2) forming thin, pointed, stake-like, usually three pronged, flat, apical plate (Fig. 7).

74. *Female S6 with differentiated external lateral series of long setae on processes*: (0) absent; (1) present (Figs. 2 and 7). I have coded *Hexepeolus* as not having a differentiated external series of long setae although it seems possible that some of the more basal setae in the series of stout apical setae might be homologous with the lateral series.

75. *Female S6 length* (*excluding apical setae*) *basal to mediolateral apodeme equaling approximately*: (0) 15% of total S6 length; (1) 30–40% of total S6 length; (2) 45–60% of total S6 length; (3) 80% of total S6 length.

76. *Female S6 with lateral membranous flap*: (0) absent (Fig. 7); (1) present, posterior margin of mediolateral apodeme not distinct from lateral margin of process (Fig. 2).

77. *Female S6 with inner margin of basal apodeme*: (0) membranous or weakly sclerotized (Fig. 13); (1) heavily sclerotized along majority of length (Fig. 7).

78. *Female S6 with inner basal margin, near mediolateral apodeme*: (0) not clearly meeting outer margin (Figs. 11 and 12); (1) distinctly meeting outer margin, forming sclerotized V or U shape (Figs. 7 and 13).

79. *Female S6 with digitiform appendage of basal apodeme*: (0) absent (Fig. 2); (1) present, strongly protruding (Fig.7); (2) present, weakly protruding.

80. *Female S6 with digitiform appendage of basal apodeme*: (0) attached sub-basally, widely mesad main basal apodeme (Fig. 11); (1) attached sub-basally, proximal to main basal apodeme (Fig. 7); (2) attached basally, apparently brought into close proximity of basal apodeme by way of a crease or fold in the integument between the apodeme and appendage (Fig. 13). Character state 2 is found in many *Epeolus*. It seems likely that this appendage is homologous to those found in other epeolines due to the observation that the appendage is not folded next to the apodeme in *Epeolus lectoides* (Fig. 8).

81. *Female S6 with basolateral sclerotic band of disk*: (0) absent (Fig. 7); (1) present (Fig. 2).

82. *Male S7 with distinct distal process*: (0) absent, lacking medial constriction forming process (Figs. 56–58); (1) present (Fig. 16).

83. *Male S7 with apical, median emargination*: (0) absent (Figs. 56 and 57); (1) present (Fig. 16).

84. *Male S7 with apical, sublateral emarginations*: (0) absent (Figs. 64–67); (1) present (Fig. 16).

85. *Male S7 with apices of lateral lobes on distal process*: (0) beyond interlobal area (Fig. 68); (1) not extending as far as interlobal area (Fig. 81).

86. *Male S7 with lateral margins of distal process*: (0) roughly straight, parallel sided (Fig. 77); (1) roughly straight, widest basally (Fig. 64); (2) roughly straight, widest apically (Fig. 67); (3) rounded, giving plate a circular appearance (Fig. 79).

87. *Male S7 with setae along lateral margins of distal process*: (0) absent or sparse (Fig. 85); (1) numerous, primarily simple (Fig. 82); (2) numerous, primarily branched (Fig. 64). The long setae found in *Rhogepeolus* are especially branched. The branched nature of the setae is difficult to observe without use of a compound microscope.

88. *Male S7 with setae in distinct pocket formed in emargination near lateral lobe on ventral surface of distal process*: (0) absent; (1) present (Figs. 86–95).

89. *Male S7 with setae on dorsal surface of lateral lobes of distal process*: (0) absent; (1) present (Figs. 68–76).

90. *Male S8 with distinct lateral apodemes*: (0) absent (Fig. 63); (1) short, rounded (Fig. 62); (2) long, angular (Figs. 59 and 96); (3) long, rounded (Figs. 98 and 99).

91. *Male S8 with medioapical process*: (0) absent (Fig. 59); (1) clearly defined (Fig. 17).

92. *Male S8 with sides of medioapical process*: (0) not emarginate (Fig. 17); (1) emarginate medially (Figs. 114–118); (2) feebly emarginate apically (Figs. 107 and 108).

93. *Male ventral gonocoxite with prominent lobe on inner surface*: (0) absent; (1) present (Fig. 136).

94. *Male gonocoxite with median ventral margin*: (0) approximately straight or gently sloping (Fig. 135); (1) distinctly emarginate (Fig. 137).

95. *Gonostylus*: (0) simple, composed of a single structure (Fig. 128B); (1) composed of a single elongate process that is angled basally into a lobe (Fig. 129); (2) composed of two distinct, elongate processes (Fig. 130).

96. *Penis valves with dorsal connecting bridge*: (0) not discernable; (1) expanded into spatha; (2) roughly triangular; (3) roughly bar shaped. There is a marked tendency for *Doeringiella* and *Triepeolus* (but not *Triepeolus epeolurus*, *Triepeolus heterurus*, or old world *Triepeolus*) to have an elongate dorsal bridge relative to other epeolines in which this structure is bar shaped; however, intergradation made coding of distinct character states difficult.

97. *Penis valves with dorsal connecting bridge*: (0) well sclerotized; (1) poorly sclerotized.

98. *Penis valve with dorsobasal lobe*: (0) absent; (1) present, not conspicuously covering basolateral margins of penis; (2) present, conspicuously covering basolateral margins of penis.

99. *Penis and penis valve with articulating surfaces*: (0) curved; (1) highly recurved, scroll-like (Fig. 145).

100. *Penis valve*: (0) lacking inner, medial projection; (1) with inner, medial projection (Fig. 131).

101. *Penis with small lamellate projection on dorsolateral margin*: (0) absent (Fig. 144); (1) present medially (Fig. 145); (2) present subapically (Fig. 143).

102. *Penis with widely divergent, fleshy lobe on lateral margin*: (0) absent; (1) present (Fig. 141).

APPENDIX 2 Data matrix of morphological character states. - = not applicable; + = multistate (in both cases 2,3).

Characters 1-51

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Biastes	0	4	1	0	0	0	0	1	0	1	2	1	0	0	0	0	1	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	-	0	1	1	1	1	0	2	0	0	0	2	1	1	0	0	0	1	0
Brachynomada	0	4	1	0	0	0	0	0	0	1	1	1	3	0	0	1	1	1	0	0	0	0	1	2	0	0	0	0	0	0	0	0	-	0	1	1	1	1	0	0	0	0	0	2	0	0	0	2	1	1	0
Hexepeolus	1	5	1	0	2	0	1	2	0	1	2	1	3	0	0	0	1	1	0	0	0	0	0	2	1	1	1	0	0	0	0	0	-	0	1	1	0	0	1	2	0	0	1	0	0	0	2	2	1	1	0
Holcopasites	0	5	1	0	0	0	1	1	0	1	2	1	2	0	0	0	1	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	-	0	1	0	1	0	0	2	0	0	0	2	1	1	0	1	0	1	0
Nomada	0	5	1	0	2	0	0	0	0	0	1	0	3	0	0	0	1	1	0	0	0	0	1	2	0	0	2	0	0	0	0	0	-	0	2	1	0	1	1	0	0	0	1	0	1	1	0	0	0	1	0
R. bigibbosus	1	+	0	1	1	1	1	1	0	2	2	1	3	0	0	1	0	1	0	0	0	1	1	2	0	0	2	0	0	0	1	1	0	0	1	0	0	0	1	1	1	0	1	2	1	2	0	2	1	2	1
R. emarginatus	1	2	0	1	0	1	0	3	0	2	2	1	3	0	0	1	0	1	0	0	0	1	2	2	0	0	2	0	0	0	1	1	0	0	1	0	0	0	1	1	1	0	1	2	1	2	0	1	1	2	1
O. armata	1	0	1	1	1	1	1	1	1	2	0	0	2	0	0	1	1	0	0	0	0	0	1	1	2	0	0	2	0	1	0	0	1	1	0	2	1	1	1	0	0	1	0	1	0	0	1	0	0	0	2	0
O. batesi	1	1	1	1	1	1	1	1	1	2	0	0	3	0	0	1	1	0	0	0	0	0	1	1	2	0	0	2	0	0	0	0	1	1	0	2	1	1	0	0	0	1	0	1	0	0	1	0	0	1	2	1
Thalestria	1	1	0	1	1	0	1	2	1	2	0	0	2	0	1	1	1	0	0	0	1	1	1	2	0	0	2	0	2	0	0	1	0	1	0	0	0	0	0	1	1	1	1	1	2	2	1	0	1	1	1	0
Rhinepeolus	1	1	0	1	1	0	0	3	0	2	1	1	3	0	0	1	0	1	0	0	1	1	2	1	1	0	0	0	2	0	0	1	0	2	1	0	0	0	1	0	1	0	1	2	2	2	1	2	1	0	0
D. bizonata	1	1	0	1	2	0	1	2	0	2	1	1	3	1	1	1	0	2	0	0	3	1	1	2	0	2	1	0	0	0	0	1	0	1	1	0	0	0	1	1	1	1	1	2	2	2	2	2	1	1	0
D. cingillata	1	+	0	1	2	0	1	2	0	2	1	1	3	1	1	1	0	1	0	0	3	1	1	2	0	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0	1	1	1	2	2	2	2	2	1	1	0
D. crassicornis	1	1	0	1	2	0	1	2	0	2	1	1	3	1	1	1	0	1	0	0	2	1	0	2	0	1	1	0	0	0	0	1	0	1	1	0	0	0	1	0	1	1	1	2	2	2	2	2	1	1	0
D. crinita	1	1	0	1	2	0	1	2	0	2	1	1	3	1	1	1	0	1	0	0	2	1	0	2	0	1	1	0	0	0	0	1	0	1	1	0	0	0	1	0	1	1	1	2	2	2	2	2	1	1	0
D. holmbergi	1	1	0	1	2	0	1	2	0	2	1	1	3	1	1	1	0	1	0	0	3	1	1	2	0	1	1	0	0	0	0	1	0	1	1	0	0	0	1	0	1	1	1	2	2	2	2	2	1	1	0
Pseudepeolus	1	1	0	1	2	0	1	2	0	2	0	1	1	0	0	1	0	1	0	0	3	1	2	1	0	0	2	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	1	2	2	2	1	2	1	1	0
T. ancoratus	1	3	0	1	0	0	1	2	0	2	0	0	2	0	0	1	0	1	0	0	4	1	2	1	0	2	2	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	1	2	2	0	2	1	0	0
T. distinctus	1	2	0	1	1	0	1	2	0	2	1	0	2	0	0	1	0	1	0	0	3	1	2	1	0	2	2	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	2	1	2	0	2	1	1	0
T. epeolurus	1	2	0	1	3	0	1	2	0	2	0	1	3	0	0	1	0	1	0	0	3	1	2	1	0	2	1	0	0	0	0	1	0	0	1	0	0	0	1	1	1	0	1	2	2	2	1	2	1	1	0
T. heterurus	1	2	0	1	2	0	1	2	0	2	0	0	2	0	0	1	0	1	0	0	4	1	2	1	0	2	1	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	2	2	2	0	2	1	2	0
T. kathrynae	1	2	0	1	0	0	1	2	0	2	0	0	2	0	0	1	0	1	0	0	4	1	2	1	0	2	1	0	0	0	0	1	0	0	1	0	0	0	1	1	1	0	1	2	1	2	0	2	1	2	0
T. lunatus	1	3	0	1	0	0	1	2	1	2	0	0	2	0	0	1	0	1	0	0	4	1	2	1	0	2	2	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	2	2	2	0	2	1	0	0
T. nobilis	1	1	0	1	0	0	1	2	0	2	0	0	2	0	0	1	0	1	0	0	4	1	2	1	0	2	2	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	2	2	2	0	2	1	0	0
T. quadrifasciatus	1	3	0	1	2	0	1	1	0	2	0	0	2	0	0	1	0	1	0	0	4	1	2	1	0	2	2	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	2	2	2	0	2	1	1	0
T. tristis	1	3	0	1	1	0	1	2	0	2	1	0	2	0	0	1	0	1	0	0	3	1	2	1	0	2	2	0	0	0	0	1	0	1	1	0	0	0	1	0	1	0	1	2	2	2	1	2	1	1	0
T. ventralis	1	3	0	1	0	0	1	2	0	2	1	0	2	0	0	1	0	1	0	0	3	1	2	1	0	2	2	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	2	2	2	1	2	1	1	0
T. vicinus	1	3	0	1	0	0	1	2	1	2	0	0	2	0	0	1	0	1	0	0	4	1	2	1	0	2	2	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	2	2	2	0	2	1	1	0
E. compactus	1	1	0	1	2	1	1	2	0	2	1	1	2	0	0	1	0	2	0	1	3	1	2	1	0	1	2	0	0	1	0	1	0	1	1	0	0	0	1	1	1	0	1	1	2	2	0	2	1	0	0
E. lectoides	1	1	0	1	1	0	1	2	0	2	1	0	1	0	0	1	0	2	1	1	3	1	2	1	0	2	1	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	1	2	2	0	2	1	0	0
E. mesillae	1	1	0	1	1	1	1	2	0	2	1	1	1	0	0	1	0	2	0	0	3	1	1	2	0	2	1	0	0	0	0	1	0	2	1	0	0	0	1	1	1	0	1	1	2	1	0	2	1	1	0
E. natalensis	1	2	0	1	2	1	1	4	0	2	1	1	2	0	0	1	0	1	0	1	3	1	2	2	0	0	2	0	0	0	0	1	2	1	1	0	0	0	1	1	1	0	1	1	2	2	0	2	1	1	0
E. schummeli	1	1	0	1	2	1	1	2	0	2	1	1	2	0	0	1	0	2	0	1	3	1	2	1	0	0	2	0	0	1	0	1	0	1	1	0	0	0	1	1	1	0	1	1	2	2	0	2	1	0	0
E. t. rozenburgensis	1	1	0	1	2	1	1	4	0	2	1	1	1	0	0	1	0	2	0	1	3	1	2	2	0	2	1	0	0	1	0	1	0	1	1	0	0	0	1	1	1	0	1	1	2	2	0	2	1	0	0
E. bifasciatus	1	1	0	1	2	1	1	2	0	2	1	1	1	0	0	1	0	1	2	2	3	0	2	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	1	1	1	0	1	1	2	2	0	2	1	1	0
E. variolosus	1	1	0	1	1	1	1	2	0	2	1	1	0	0	0	1	0	2	2	2	3	0	2	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	1	0	1	0	1	1	2	2	0	2	1	1	0

	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
Biastes	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	3	0	0	0	0	-	0	0	0	0	-	-	-	-	-	1	1	0	0	0	0	1	1	1	0	0	0	0
Brachynomada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	-	0	1	1	2	0	1	0	0	-	0	1	1	0	-	2	0	0	0	2	1	0	1	0	2	1	0	0	0	0	0	0
Hexepeolus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	1	0	1	0	-	1	0	1	0	-	-	-	-	-	2	0	-	0	0	0	1	0	1	0	0	0	0
Holcopasites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	2	1	1	1	0	-	1	0	0	0	-	-	-	-	-	0	0	-	0	0	0	0	-	0	0	0	0	0
Nomada	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	0	2	1	1	0	0	-	1	0	0	0	-	-	-	-	-	2	1	0	0	0	0	4	0	0	0	0	0	0
R. bigibbosus	0	0	1	0	1	3	0	0	1	0	0	2	1	0	1	0	0	1	1	1	0	0	1	1	2	0	0	0	1	0	0	1	1	0	-	1	2	0	0	2	1	0	0	0	0	1	0	1	0	1	0	0
R. emarginatus	0	0	1	0	1	3	0	0	1	0	0	0	1	1	1	0	0	1	1	1	0	0	1	1	2	0	0	0	1	0	0	1	1	0	-	0	2	0	0	2	1	0	0	0	0	1	0	1	0	1	0	0
O. armata	0	1	1	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	2	0	0	0	1	0	0	1	1	0	-	2	2	0	0	3	1	0	0	0	0	1	0	1	0	1	0	0
O. batesi	0	1	1	0	1	4	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	2	0	0	0	1	0	0	1	1	0	-	2	2	0	0	3	1	0	0	0	0	1	0	1	0	1	0	0
Thalestria	0	0	0	0	0	1	0	2	0	1	1	0	0	2	1	0	1	3	3	0	1	2	1	0	0	0	1	0	-	0	1	1	1	0	0	0	0	0	2	1	0	0	0	0	2	0	2	0	1	2	0
Rhinepeolus	0	0	0	0	0	5	0	0	0	1	1	2	1	2	1	1	1	2	3	0	1	2	1	1	0	1	0	0	-	0	1	1	1	1	0	0	0	0	2	1	0	0	0	0	3	0	2	0	1	0	0
D. bizonata	0	0	0	0	0	5	0	1	0	1	1	2	1	2	1	0	1	2	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	0	0	2	1	1	0	1	0	3	0	2	1	1	0	0
D. cingillata	0	0	0	1	0	5	0	1	0	1	1	2	1	1	1	1	1	2	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	0	0	2	1	1	1	1	0	3	0	2	1	1	1	0
D. crassicornis	0	0	0	1	0	5	0	1	0	1	1	2	1	2	1	0	1	2	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	1	0	1	0	0	2	1	1	1	1	0	3	0	2	1	1	1	0
D. crinita	0	0	0	1	0	5	0	1	0	1	1	2	1	2	1	1	1	2	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	1	3	1	0	0	2	1	1	1	1	0	3	0	2	1	1	1	0
D. holmbergi	0	0	0	1	0	5	0	1	0	1	1	2	1	1	1	1	1	2	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	0	0	2	1	1	1	1	0	3	0	2	1	1	0	0
Pseudepeolus	0	0	0	0	0	5	0	0	0	1	1	1	1	1	1	0	1	2	3	0	1	2	1	1	0	1	0	1	1	0	1	1	1	1	1	3	0	1	0	2	1	0	0	1	0	3	0	2	0	1	0	0
T. ancoratus	0	0	0	1	0	5	1	1	0	1	1	1	0	1	2	1	1	1	2	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	3	0	1	0	2	1	0	0	1	0	3	0	2	0	1	0	0
T. distinctus	0	0	0	0	1	5	0	1	0	1	1	1	0	1	2	1	0	1	2	3	0	1	2	1	1	0	1	1	2	1	0	1	0	1	1	0	0	1	0	2	1	1	0	1	0	3	0	2	0	1	0	0
T. epeolurus	2	0	0	0	1	5	1	0	0	1	1	0	1	2	1	0	1	2	3	0	1	2	1	1	0	1	1	2	1	0	1	1	1	1	1	0	0	1	0	2	1	1	0	1	0	3	0	2	0	1	0	0
T. heterurus	0	0	1	0	0	5	0	1	0	1	1	0	1	2	1	0	1	2	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	1	3	0	1	0	2	1	0	0	1	0	3	0	2	0	1	0	0
T. kathrynae	0	0	0	0	1	5	0	1	0	1	1	0	1	2	1	0	1	2	3	0	1	2	1	1	0	1	1	2	1	0	1	1	1	1	1	0	0	1	0	2	1	0	0	1	0	3	0	2	0	1	0	0
T. lunatus	0	0	0	1	1	5	1	1	0	1	1	0	1	2	1	1	1	3	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	1	3	0	1	0	2	1	0	0	1	0	3	0	2	0	1	0	0
T. osiriformis	0	0	0	1	0	5	0	1	0	1	1	1	0	1	2	1	0	1	3	3	0	1	2	1	1	0	1	1	1	1	0	1	0	1	1	3	1	1	0	2	1	0	0	1	0	3	0	2	0	1	0	0
T. quadrifasciatus	0	0	0	1	1	5	0	1	0	1	1	1	0	1	2	1	1	1	3	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	3	0	1	0	2	1	0	0	1	0	3	0	2	0	1	0	0
T. tristis	0	0	0	0	0	5	1	0	0	1	1	2	1	2	1	0	1	2	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	0	0	2	1	0	0	0	0	3	0	2	0	1	0	0
T. ventralis	0	0	0	0	1	5	1	0	0	1	1	2	1	2	1	0	1	2	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	1	3	0	1	0	2	1	0	0	0	0	3	0	2	0	1	2	0
T. vicinus	0	0	0	1	1	5	1	1	0	1	1	0	1	2	1	1	1	3	3	0	1	2	1	1	0	1	1	1	1	0	1	1	1	1	1	3	0	1	0	2	1	0	0	1	0	3	0	2	0	1	0	0
E. compactus	1	0	0	0	0	2	0	0	1	0	0	0	0	1	2	1	0	0	0	2	1	0	0	1	2	0	0	1	1	2	0	1	0	1	0	0	0	0	0	1	2	1	0	0	0	1	3	0	1	0	1	0	1
E. lectoides	1	0	0	0	0	2	0	0	1	0	1	0	1	2	1	0	0	0	2	1	0	0	1	2	0	0	1	1	1	0	1	0	1	0	0	0	0	0	1	2	1	2	0	0	1	3	1	1	0	1	0	1
E. mesillae	1	0	0	0	0	2	0	0	1	0	0	1	1	2	1	0	0	0	2	1	0	0	1	2	0	0	0	0	-	0	1	0	1	0	0	0	0	0	1	2	1	0	0	0	1	3	0	1	0	1	0	1
E. natalensis	1	0	0	0	0	2	0	0	1	0	0	0	1	2	1	0	0	0	2	1	0	0	1	2	0	1	1	1	2	0	1	0	1	0	0	0	0	0	1	2	1	0	0	0	1	3	0	1	0	1	0	1
E. schummeli	1	0	0	0	0	2	0	0	1	0	0	0	1	2	1	0	0	0	2	1	0	0	1	2	0	0	1	1	2	0	1	0	1	0	0	0	0	0	1	2	1	2	0	0	1	3	0	1	0	1	0	1
E. t. rozenburgensis	1	0	0	0	0	2	0	0	1	0	0	0	0	0	1	0	0	0	2	1	0	0	1	2	0	0	1	0	-	0	1	0	1	0	0	0	0	0	1	2	1	0	0	0	1	3	1	1	0	1	0	1
E. bifasciatus	1	0	0	0	0	2	0	0	1	0	0	0	1	2	1	0	0	0	2	1	0	0	1	2	0	0	1	2	2	0	1	0	1	0	0	0	0	0	1	2	1	2	0	0	1	3	0	1	0	1	0	0
E. variolosus	1	0	0	0	0	2	0	0	1	0	0	1	1	2	1	0	0	0	2	1	0	0	1	2	0	0	1	0	-	0	1	0	0	0	0	0	0	0	1	2	1	2	0	0	1	3	0	1	0	1	0	0

APPENDIX 3: KNOWN AND POTENTIAL *TRIEPEOLUS* HOSTS

See taxonomic entries of individual *Triepeolus* species for references and further details. The question marks after certain *Triepeolus* species indicate a less certain host association.

ANDRENIDAE

Oxaeinae

– *Protoxaea gloriosa* (Fox) – *T. kathrynae* Rozen

Protoxaea sp. – *Triepeolus* sp. 65

APIDAE

Anthophorini

– *Anthophora* (*Melea*) *bomboides* Kirby – *T. dacotensis* (Stevens)?

Anthophora (*Melea*) *occidentalis* Cresson – *T. dacotensis* (Stevens)

– *Anthophora* (*Anthophoroides*) *linsleyi* Timberlake – *T. mojavensis* Linsley

Centridini

– *Centris* sp. – *T. remigatus* (Fabricius)?

Emphorini

– *Melitoma taurea* (Say) – *T. donatus* (Smith)?

Eucerini

– *Florilegus* (*Florilegus*) *purpurascens* Cockerell – *T. buchwaldi* (Friese)

– *Melissodes* (*Callimelissodes*) *composita* Tucker – *T. helianthi* (Robertson)?

– *Melissodes* (*Eumelissodes*) *agilis* Cresson –*T. denverensis* Cockerell?, *T. helianthi* (Robertson), *T. subalpinus* Cockerell?

Melissodes (*Eumelissodes*) *denticulata* Smith – *T. michiganensis* Mitchell?

Melissodes (*Eumelissodes*) *menuachus* Cresson – *T. occidentalis* (Cresson)?

Melissodes (*Eumelissodes*) *microsticta* Cockerell – *T. paenepectoralis* Viereck?

Melissodes (*Eumelissodes*) *pallidisignata* Cockerell – *T. argyreus* Cockerell, *Triepeolus* sp. 76?

Melissodes (*Eumelissodes*) *druriella* (Kirby) – *T. pectoralis* (Robertson)?, *T. texanus* (Cresson)

Melissodes (*Eumelissodes*) *trinodis* Robertson – *T. helianthi* (Robertson)

– *Melissodes* (*Melissodes*) *bimaculata* (Lepeletier) – *T. lunatus* (Say)?

Melissodes (*Melissodes*) *tepaneca* Cresson – *T. mexicanus* (Cresson)?

Melissodes sp. – *Triepeolus* sp. 76

– *Peponapis pruinosa* (Say) – *T. remigatus* (Fabricius)?

– *Svastra* (*Epimelissodes*) *atripes atrimitra* (LaBerge) – *T. quadrifasciatus atlanticus* Mitchell

Svastra (*Epimelissodes*) *obliqua* (Say) – *T. concavus* (Cresson), *T. denverensis* Cockerell?, *T. subnitens* Cockerell & Timberlake

Svastra (*Epimelissodes*) *obliqua obliqua* (Say) – *T. rufithorax* (Graenicher)

Svastra (*Epimelissodes*) *petulca* Cresson – *T. simplex* Robertson?

Svastra (*Epimelissodes*) *sabinensis sabinensis* (Cockerell) – *T. penicilliferus* (Brues)

– *Svastra* (*Idiomelissodes*) *duplocincta* Cockerell – Triepeolus sp. 92

– *Syntrichalonia exquisita* (Cresson) – *T. intrepidus* (Smith)

– *Tetralonia* (*Tetralonia*) *malvae* Rossi – *T. tristis* (Smith)?

– *Tetraloniella* (*Tetraloniella*) *eriocarpi* (Cockerell) – *T. loomisorum* Rozen
Tetraloniella (*Tetraloniella*) *mitsukurii* Cockerell – *T. ventralis* (Meade-Waldo)
Tetraloniella (*Tetraloniella*) *nana* Morawitz – *T. tristis* (Smith)
– *Tetraloniella* (*Pectinapis*) sp. – *Triepeolus* sp. 62?
Tetraloniella sp. – *Triepeolus* sp. 95
– *Xenoglossa strenua* (Cresson) – *T. remigatus* (Fabricius)

COLLETIDAE
Caupolicanini
– *Caupolicana* (*Caupolicana*) *yarrowi* (Cresson) – *T. grandis* (Friese)
– *Ptiloglossa arizonensis* Timberlake – *T. grandis* (Friese)
Ptiloglossa jonesi Timberlake – *T. grandis* (Friese)

HALICTIDAE
Nomiinae
– *Dieunomia* (*Epinomia*) *nevadensis* (Cresson) – *T. loomisorum* Rozen, *Triepeolus* sp. 65
Dieunomia (*Epinomia*) *nevadensis bakeri* (Cockerell) – *T. martini* (Cockerell)?
Dieunomia (*Epinomia*) *triangulifera* (Vachal) – *T. distinctus* (Cresson)
– *Dieunomia* (*Dieunomia*) *heteropoda* (Say) – *T. distinctus* (Cresson), *T. helianthi* (Robertson)?, *T. remigatus* (Fabricius)
– *Nomia* (*Acunomia*) *melanderi* Cockerell – *T. helianthi* (Robertson)?, *T. texanus* (Cresson)
Nomia (*Acunomia*) *tetrazonata tetrazonata* Cockerell – *T. verbesinae* (Cockerell)

MEGACHILIDAE
Osmiini
– *Atoposmia* sp. – *Triepeolus* sp. 141?

MELITTIDAE
Dasypodaini
– *Hesperapis* sp. – *T. simplex* Robertson?

Appendix 4. New World countries known to have *Triepeolus* species, with a listing of the species from each country. Countries with a particularly large number of species are listed by state or province. NOTE: Only those species that were personally examined in this study are included.

ARGENTINA [1]: *T. osiriformis*

BAHAMAS [1]: *T. roni*

BELIZE [2]: *T. cameroni*, *T. mexicanus*

BRAZIL [2]: *T. alvarengai*, *T. osiriformis*

CANADA
ALBERTA [6]: *T. balteatus*, *T. dacotensis*, *T. helianthi*, *T. paenepectoralis*, *T. subalpinus*, sp. 101
BRITISH COLUMBIA [3]: *T. paenepectoralis*, *T. texanus*, sp. 101
MANITOBA [0]
NEW BRUNSWICK [2] *T. brittaini*, *T. pectoralis*
NEWFOUNDLAND [0]
NOVA SCOTIA [1]: *T. brittaini*
ONTARIO [1]: sp. 101
PRINCE EDWARD ISLAND [0]
QUEBEC [0]
SASKATCHEWAN [2]: *T. obliteratus*, *T. subalpinus*

COLOMBIA [3]: *T. flavipennsis*, *T. osiriformis*, *T. rufotegularis*

CUBA [4]: *T. cuabitensis*, *T. roni*, *T. vicinus*, *T. wilsoni*

DOMINICAN REPUBLIC [2]: *T. nisibonensis*, *T. victori*

ECUADOR [2]: *T. aguilari*, *T. buchwaldi*

EL SALVADOR [2]: *T. laticeps*, *T. mexicanus*

GRENADA [2]: *T. rufoclypeus*, *T. rufotegularis*

GUATEMALA [4]: *T. antiguensis*, *T. bilineatus*, *T. laticeps*, *T. mexicanus*

HONDURAS [4]: *T. aztecus*, *T. bilineatus*, *T. cameroni*, *T. mexicanus*

JAMAICA [1]: *T. rufoclypeus*

MEXICO

AGUASCALIENTES [0]
BAJA CALIFORNIA [5]: *T. grandis*, *T. heterurus*, *T. verbesinae*, spp. 74, 92
BAJA CALIFORNIA SUR [2]: spp. 65, 92
CAMPECHE [1]: *T. cameroni*
CHIAPAS [7]: *T. antiguensis*, *T. intrepidus*?, *T. lunatus*, *T. tepanicus*, *T. totonacus*, *T. zacatecus*, sp. 10
CHIHUAHUA [23]: *T. grandis*, *T. helianthi*, *T. intrepidus*, *T. kathrynae*, *T. laticeps*, *T. lunatus*, *T. martini*, *T. nevadensis*, *T. norae*, *T. penicilliferus*, *T. remigatus*, *T. rhododontus*, *T. robustus*, *T. subnitens*, *T. townsendi*, *T. verbesinae*, spp. 44, 61, 65, 74, 76, 81, 95
COAHUILA [9]: *T. helianthi*, *T. laticaudus*, *T. laticeps*, *T. lunatus*, *T. norae*, *T. penicilliferus*, *T. remigatus*, spp. 65, 177
COLIMA [4]: *T. bilineatus*, *T. laticeps*, *T. tepanicus*, *T. zacatecus*
DURANGO [20]: *T. antiguensis*, *T. bilineatus*, *T. grandis*, *T. kathrynae*, *T. laticaudus*, *T. laticeps*, *T. loomisorum*, *T. lunatus*, *T. medusa*, *T. nevadensis*, *T. norae*, *T. penicilliferus*, *T. remigatus*, *T. robustus*, *T. subnitens*, spp. 44, 59, 61, 74, 81
GUANAJUATO [5]: *T. bilineatus*, *T. grandis*, *T. laticeps*, *T. medusa*, sp. 141
GUERRERO [3]: *T. bilineatus*, *T. laticeps*, sp. 43
HIDALGO [7]: *T. antiguensis*, *T. bilineatus*, *T. intrepidus*, *T. medusa*, *T. townsendi*, spp. 62, 141
JALISCO [14]: *T. bilineatus*, *T. epeolurus*, *T. grandis*, *T. intrepidus*, *T. laticeps*, *T. medusa*, *T. mexicanus*, *T. remigatus*, *T. tepanicus*, *T. totonacus*, *T. zacatecus*, spp. 10, 19, 95
MÉXICO [2]: *T. laticeps*, *T. medusa*
MICHOACÁN [11]: *T. antiguensis*, *T. bilineatus*, *T. epeolurus*, *T. intrepidus*, *T. laticeps*, *T. tepanicus*, *T. totonacus*, *T. zacatecus*, spp. 10, 43, 141
MORELOS [8]: *T. antiguensis*, *T. bilineatus*, *T. kathrynae*, *T. intrepidus*, *T. laticeps*, *T. mexicanus*, spp. 43, 141
NAYARIT [6]: *T. bilineatus*, *T. medusa*, *T. mexicanus*, *T. tepanicus*, spp. 10, 11
NUEVO LEÓN [4]: *T. helianthi*, *T. intrepidus*, *T. kathrynae*, *T. rufoclypeus*
OAXACA [10]: *T. bilineatus*, *T. epeolurus*, *T. grandis*, *T. intrepidus*, *T. mexicanus*, *T. totonacus*, *T. zacatecus*, spp. 10, 19, 43
PUEBLA [7]: *T. antiguensis*, *T. bilineatus*, *T. laticeps*, *T. totonacus*, spp. 10, 43, 49
QUERÉTARO [3]: *T. bilineatus*, *T. grandis*, *T. laticeps*
QUINTANA ROO [1]: *T. cameroni*
SAN LUIS POTOSÍ [6]: *T. bilineatus*, *T. laticeps*, *T. lunatus*, *T. mexicanus*, *T. remigatus*, *T. zacatecus*
SINALOA [7]: *T. mexicanus*, *T. remigatus*, *T. rufoclypeus*, *T. verbesinae*, *T. zacatecus*, spp. 19, 110
SONORA [11]: *T. grandis*, *T. laticeps*, *T. lunatus*, *T. medusa*, *T. mexicanus*, *T. penicilliferus*, *T. verbesinae*, *T. zacatecus*, spp. 19, 59, 110
TABASCO [0]

TAMAULIPAS [5]: *T. cameroni*, *T. mexicanus*, *T. penicilliferus*, *T. rufoclypeus*, *T. zacatecus*
TLAXCALA [0]
VERACRUZ [5]: *T. cameroni*, *T. lunatus*, *T. mexicanus*, *T. zacatecus*, sp. 10
YUCATÁN [2]: *T. cameroni*, *T. grandis*
ZACATECAS [9]: *T. grandis*, *T. intrepidus*, *T. laticeps*, *T. lunatus*, *T. norae*, *T. remigatus*, spp. 44, 74, 141
DIST. FEDERAL [2]: *T. grandis*, *T. medusa*
MEXICO (UNSPECIFIED) [1]: *T. aztecus*

NICARAGUA [1]: *T. mexicanus*

PANAMA [1]: *T. mexicanus*

PARAGUAY [1]: *T. osiriformis*

PERU [3]: *T. aguilari*, *T. atoconganus*, *T. buchwaldi*

SAINT VINCENT AND THE GRENADINES [1]: *T. rufotegularis*

TRINIDAD [1]: *T. osiriformis*

USA
ALABAMA [5]: *T. quadrifasciatus atlanticus*, *T. concavus*, *T. cressonii*, *T. lunatus*, *T. rufithorax*
ARIZONA [42]: *T. concavus*, *T. denverensis*, *T. distinctus*, *T. fraserae*, *T. grandis*, *T. helianthi*, *T. intrepidus*, *T. kathrynae*, *T. laticaudus*, *T. laticeps*, *T. loomisorum*, *T. lunatus*, *T. martini*, *T. mexicanus*, *T. micropygius*, *T. norae*, *T. pectoralis*, *T. penicilliferus*, *T. remigatus*, *T. rhododontus*, *T. robustus*, *T. subalpinus*, *T. sublunatus*, *T. subnitens*, *T. texanus*, *T. townsendi*, *T. verbesinae*, spp. 2, 39, 44, 51, 59, 60,63, 65, 74, 76, 90, 92, 95, 110, 179
ARKANSAS [7]: *T. atripes*, *T. concavus*, *T. lunatus*, *T. pectoralis*, *T. q. quadrifasciatus*, *T. rhododontus*, *T. simplex*
CALIFORNIA [29]: *T. argyreus*, *T. californicus*, *T. concavus*, *T. diversipes*, *T. fraserae*, *T. helianthi*, *T. heterurus*, *T. lunatus*, *T. micropygius*, *T. mojavensis*, *T. norae*, *T. paenepectoralis*, *T. penicilliferus*, *T. remigatus*, *T. robustus*, *T. subalpinus*, *T. subnitens*, *T. verbesinae*, spp. 39, 42, 51, 59, 78, 90, 134, 143, 144, 170, 172
COLORADO [28]: *T. balteatus*, *T. concavus*, *T. dacotensis*, *T. denverensis*, *T. distinctus*, *T. diversipes*, *T. eldoradensis*, *T. fraserae*, *T. helianthi*, *T. laticaudus*, *T. lunatus*, *T. martini*, *T. micropygius*, *T. occidentalis*, *T. paenepectoralis*, *T. pectoralis*, *T. penicilliferus*, *T. remigatus*, *T. rhododontus*, *T. rohweri*, *T. subalpinus*, *T. tanneri*, *T. texanus*, *T. townsendi*, spp. 51, 59, 63, 76, 95
CONNECTICUT [4]: *T. donatus*, *T. helianthi*, *T. lunatus*, *T. pectoralis*
DELAWARE [4]: *T. donatus*, *T. helianthi*, *T. lunatus*, *T. remigatus*

FLORIDA [8]: *T. quadrifasciatus atlanticus*, *T. concavus*, *T. donatus*, *T. georgicus*, *T. lunatus*, *T. monardae*, *T. rufithorax*, *T. rugosus*
GEORGIA [13]: *T. quadrifasciatus atlanticus*, *T. atripes*, *T. concavus*, *T. cressonii*, *T. distinctus*, *T. georgicus*, *T. lunatus*, *T. monardae*, *T. nevadensis*, *T. pectoralis*, *T. remigatus*, *T. rufithorax*, *T. simplex*
IDAHO [13]: *T. argyreus*, *T. balteatus*, *T. concavus*, *T. eldoradensis*, *T. heterurus*, *T. micropygius*, *T. occidentalis*, *T. paenepectoralis*, *T. pectoralis*, *T. subalpinus*, *T. texanus*, spp. 59, 76
ILLINOIS [12]: *T. quadrifasciatus atlanticus*, *T. atripes*, *T. concavus*, *T. cressonii*, *T. distinctus*, *T. donatus*, *T. helianthi*, *T. lunatus*, *T. micropygius*, *T. pectoralis*, *T. remigatus*, *T. simplex*
INDIANA [9]: *T. concavus*, *T. cressonii*, *T. donatus*, *T. helianthi*, *T. lunatus*, *T. pectoralis*, *T. remigatus*, *T. simplex*, sp. 101
IOWA [5]: *T. distinctus*, *T. donatus*, *T. lunatus*, *T. remigatus*, *T. simplex*
KANSAS [22]: *T. concavus*, *T. cressonii*, *T. distinctus*, *T. grandis*, *T. helianthi*, *T. laticaudus*, *T. lunatus*, *T. martini*, *T. occidentalis*, *T. pectoralis*, *T. penicilliferus*, *T. q. quadrifasciatus*, *T. remigatus*, *T. rhododontus*, *T. scelestus*, *T. simplex*, *T. subalpinus*, *T. subnitens*, *T. tanneri*, spp. 2, 65, 76
KENTUCKY [0]
LOUISIANA [6]: *T. concavus*, *T. cressonii*, *T. lunatus*, *T. q. quadrifasciatus*, *T. remigatus*, *T. simplex*
MAINE [2]: *T. donatus*, *T. pectoralis*
MARYLAND [8]: *T. quadrifasciatus atlanticus*, *T. atripes*, *T. cressonii*, *T. donatus*, *T. helianthi*, *T. lunatus*, *T. pectoralis*, *T. remigatus*
MASSACHUSETTS [2]: *T. donatus*, *T. pectoralis*
MICHIGAN [6]: *T. concavus*, *T. donatus*, *T. lunatus*, *T. michiganensis*, *T. pectoralis*, sp. 101
MINNESOTA [9]: *T. concavus*, *T. cressonii*, *T. distinctus*, *T. donatus*, *T. helianthi*, *T. pectoralis*, *T. obliteratus*, *T. rhododontus*, *T. simplex*
MISSISSIPPI [12]: *T. quadrifasciatus atlanticus*, *T. atripes*, *T. concavus*, *T. cressonii*, *T. georgicus*, *T. helianthi*, *T. lunatus*, *T. micropygius*, *T. pectoralis*, *T. remigatus*, *T. rhododontus*, *T. simplex*
MISSOURI [11]: *T. quadrifasciatus atlanticus*, *T. atripes*, *T. concavus*, *T. cressonii*, *T. donatus*, *T. helianthi*, *T. lunatus*, *T. pectoralis*, *T. penicilliferus*, *T. rhododontus*, *T. simplex*
MONTANA [7]: *T. balteatus*, *T. denverensis*, *T. fraserae*, *T. helianthi*, *T. micropygius*, *T. subalpinus*, *T. texanus*
NEBRASKA [9]: *T. balteatus*, *T. cressonii*, *T. distinctus*, *T. helianthi*, *T. lunatus*, *T. martini*, *T. micropygius*, *T. pectoralis*, sp. 76
NEVADA [13]: *T. argyreus*, *T. helianthi*, *T. heterurus*, *T. micropygius*, *T. nevadensis*, *T. norae*, *T. paenepectoralis*, *T. robustus*, *T. subnitens*, spp. 39, 42, 51, 59
NEW HAMPSHIRE [3]: *T. donatus*, *T. michiganensis*, *T. pectoralis*
NEW JERSEY [10]: *T. quadrifasciatus atlanticus*, *T. cressonii*, *T. donatus*, *T. helianthi*, *T. lunatus*, *T. pectoralis*, *T. remigatus*, *T. rugosus*, *T. obliteratus*, sp. 101

NEW MEXICO [39]: *T. balteatus*, *T. concavus*, *T. denverensis*, *T. distinctus*, *T. diversipes*, *T. fraserae*, *T. grandis*, *T. helianthi*, *T. intrepidus*, *T. kathrynae*, *T. laticaudus*, *T. laticeps*, *T. loomisorum*, *T. lunatus*, *T. martini*, *T. medusa*, *T. micropygius*, *T. norae*, *T. pectoralis*, *T. penicilliferus*, *T. remigatus*, *T. rhododontus*, *T. robustus*, *T. subalpinus*, *T. sublunatus*, *T. subnitens*, *T. townsendi*, *T. verbesinae*, spp. 2, 44, 59, 63, 65, 74, 76, 92, 95, 174, 179
NEW YORK [8]: *T. atripes*, *T. donatus*, *T. helianthi*, *T. lunatus*, *T. michiganensis*, *T. pectoralis*, *T. remigatus*, *T. rhododontus*
NORTH CAROLINA [15]: *T. quadrifasciatus atlanticus*, *T. atripes*, *T. concavus*, *T. cressonii*, *T. helianthi*, *T. lunatus*, *T. mitchelli*, *T. monardae*, *T. nevadensis*, *T. nigrihirtus*, *T. pectoralis*, *T. remigatus*, *T. obliteratus*, *T. rhododontus*, *T. simplex*
NORTH DAKOTA [11]: *T. cressonii*, *T. dacotensis*, *T. denverensis*, *T. donatus*, *T. fraserae*, *T. helianthi*, *T. obliteratus*, *T. occidentalis*, *T. pectoralis*, *T. subalpinus*, sp. 76
OHIO [3]: *T. donatus*, *T. lunatus*, *T. pectoralis*
OKLAHOMA [10]: *T. concavus*, *T. cressonii*, *T. grandis*, *T. nevadensis*, *T. penicilliferus*, *T. q. quadrifasciatus*, *T. remigatus*, *T. simplex*, *T. subnitens*, sp. 65
OREGON [10]: *T. argyreus*, *T. balteatus*, *T. diversipes*, *T. helianthi*, *T. heterurus*, *T. micropygius*, *T. paenepectoralis*, *T. texanus*, spp. 76, 134
PENNSYLVANIA [6]: *T. atripes*, *T. cressonii*, *T. donatus*, *T. lunatus*, *T. pectoralis*, *T. remigatus*, *T. laticaudus*, *T. laticeps*,
RHODE ISLAND [0]
SOUTH CAROLINA [3]: *T. lunatus*, *T. rhododontus*, *T. simplex*
SOUTH DAKOTA [6]: *T. cressonii*, *T. helianthi*, *T. laticaudus*, *T. lunatus*, *T. pectoralis*, *T. rhododontus*
TENNESSEE [4]: *T. cressonii*, *T. lunatus*, *T. remigatus*, *T. rhododontus*
TEXAS [38]: *T. atripes*, *T. bilineatus*, *T. concavus*, *T. cressonii*, *T. distinctus*, *T. grandis*, *T. helianthi*, *T. intrepidus*, *T. kathrynae*, *T. laticaudus*, *T. laticeps*, *T. loomisorum*, *T. lunatus*, *T. martini*, *T. nevadensis*, *T. nigrihirtus*, *T. norae*, *T. penicilliferus*, *T. q. quadrifasciatus*, *T. remigatus*, *T. rhododontus*, *T. robustus*, *T. rufoclypeus*, *T. scelestus*, *T. simplex*, *T. subnitens*, *T. texanus*, *T. townsendi*, spp. 2, 18, 37, 44, 59, 61, 65, 80, 92, 95, 97
UTAH [29]: *T. balteatus*, *T. concavus*, *T. dacotensis*, *T. denverensis*, *T. distinctus*, *T. diversipes*, *T. eldoradensis*, *T. fraserae*, *T. helianthi*, *T. heterurus*, *T. lunatus*, *T. micropygius*, *T. norae*, *T. paenepectoralis*, *T. pectoralis*, *T. rhododontus*, *T. robustus*, *T. subalpinus*, *T. subnitens*, *T. tanneri*, *T. texanus*, *T. townsendi*, spp. 39, 42, 51, 59, 65, 76, 174
VERMONT [2]: *T. donatus*, *T. pectoralis*
VIRGINIA [5]: *T. quadrifasciatus atlanticus*, *T. helianthi*, *T. lunatus*, *T. pectoralis*, *T. remigatus*
WASHINGTON [7]: *T. argyreus*, *T. concavus*, *T. helianthi*, *T. paenepectoralis*, *T. texanus*, *T. verbesinae*, sp. 76
WEST VIRGINIA [2]: *T. donatus*, *T. lunatus*

WISCONSIN [8]: *T. concavus*, *T. cressonii*, *T. donatus*, *T. helianthi*, *T. lunatus*, *T. pectoralis*, *T. obliteratus*, sp. 101
WYOMING [8]: *T. balteatus*, *T. eldoradensis*, *T. fraserae*, *T. helianthi*, *T. heterurus*, *T. paenepectoralis*, *T. subalpinus*, *T. texanus*
WASHINGTON, D. C. [4]: *T. concavus*, *T. lunatus*, *T. pectoralis*, *T. remigatus*

VENEZUELA [2]: *T. rufotegularis*, sp. 169

Appendix 5. Taxonomic histories of species originally described in *Triepeolus* or subsequently placed in *Triepeolus*, now confirmed to belong to other genera.

EPEOLUS BANKSI (COCKERELL)

Triepeolus banksi Cockerell 1907d: 135-136.
Epeolus banksi; Mitchell 1962: 442.

EPEOLUS FLAVOFASCIATUS SMITH

Epeolus flavofasciatus Smith 1879: 103.
Triepeolus flavofasciatus; Cockerell 1904: 36.
Triepeolus agaricifer Cockerell 1907c: 60. **new synonymy**

Comments.—Brumley (1965: 30-33) redescribed this species under a manuscript name.

EPEOLUS MINIMUS (ROBERTSON)

Triepeolus minimus Robertson 1902: 81.
Argyroselenis minima; Robertson 1903: 284.
Epeolus minimus; Brumley 1965: 56-60.

EPEOLUS SCUTELLARIS SAY

Epeolus scutellaris Say 1825: 85-86.
Triepeolus scutellaris; Lovell & Cockerell 1905: 42.

DOERINGIELLA GAYI (SPINOLA)

Epeolus gayi Spinola 1851: 188-189.
Triepeolus fazi Cockerell 1925c: 493-494; Roig-Alsina 1989: 601 [synonymy].
Triepeolus gayi; Cockerell 1925c:494.
Doeringiella gayi; Moure 1954: 267-268.

DOERINGIELLA HOLMBERGI (SCHROTTKY)

Epeolus variegatus Holmberg 1886c: 279 [nec Linnaeus].
Epeolus holmbergi Schrottky 1913: 265 [replacement name].
Triepeolus pruinosus Cockerell 1917a: 478-479; Moure 1955: 126 [synonymy].
Doeringiella holmbergi; Moure 1954: 267.

Figure Captions.

Fig. 1. Sclerites of the sting apparatus of a generalized *Triepeolus*, with synonymous terminology given in parentheses. See Morphology section of text for further explanation.

Figs. 2–6. Sixth sterna of female Nomadinae, ventral view. Scale bars = 1 mm. BSB = Basolateral sclerotic band.

Figs. 7–13. Sixth sterna of female Epeolini, ventral view (Figs. 8 and 9, basal portion of sterna only). Scale bars = 1 mm. DBA = Digitiform appendage of the basal apodeme.

Figs. 14–17. Labeled internal sclerites of the metasoma. 14. Female hemitergite 7, lateral view. The lateral process of this sclerite articulates with S6. 15. Female hemitergite 8, lateral view. The lower left angle of this sclerite articulates with the gonangulum. 16. Male S7, ventral view. 17. Male S8, ventral view. Fig. 18. Labeled regions of the metasoma, dorsal view. Fig. 19. Labeled regions of the male pygidial plate.

Fig. 20. Summary of phylogenetic relationships of epeoline genera presented in Fig. 21. Images right of genus names are, from top to bottom, *Odyneropsis* (*Parammobates*) *batesi*, *Rhogepeolus bigibbosus*, *Epeolus mesillae*, *Doeringiella bizonata*, *Thalestria spinosa*, *Pseudepeolus fasciatus*, *Rhinepeolus rufiventris*, and *Triepeolus kathrynae*.

Figs. 21A and B. Topology of the strict consensus of 396 most parsimonious trees (L = 404, CI = 41, RI = 71) based on 102 morphological characters (Thalestriina shown in Fig. 21b). The character list and data matrix are found in Appendices 2 and 3, respectively. Black bars represent unique, unreversed transformations; gray bars are unique transformations that are reversed on more terminal nodes; white bars are transformations that appear more than once on the tree. Numbers left of the colons refer to character number; numbers right of the colons indicate the character-state transformation. Characters in bold-faced italics are reversals.

Figs. 22A and B. Phylogenetic analyses of Thalestriina. Where applicable, clades represented by several species in the analyses are shown collapsed as a single branch. Only those characters supporting relationships between two or more clades are shown. Black bars represent unique, unreversed transformations; gray bars are unique transformations that are reversed on more terminal nodes; white bars are transformations that appear more than once on the tree. Numbers left of the colons refer to character number; numbers right of the colons indicate the character-state transformation. A. Strict consensus of 90 most parsimonious trees (L = 144, CI = 40, RI = 57) using only *Epeolus natalensis* as the outgroup. B. Strict consensus of 70 most parsimonious trees (L = 203, CI = 44, RI = 71) using all *Epeolus* listed in Table 3 except for *Epeolus bifasciatus* and *Epeolus variolosus* (i.e., those *Epeolus* belonging to *Trophocleptria*, sensu Michener, 2000). See Phylogenetic Results for further explanation.

Figs. 23–29. Maxillary palpi of Nomadinae. 23. *Hexepeolus rhodogyne*. 24. *Nomada pampicola*. 25. *Brachynomada scotti*. 26. *Triepeolus lunatus*. 27. *Triepeolus kathrynae*. 28. *Odyneropsis batesi*. 29. *Odyneropsis armata*. Figs. 30–33. Diagrammatic view of posterior surfaces of head capsules, showing various character-states of the preoccipital carina; redrawn from Roig-Alsina (1989). See character 21, Appendix 2 for further details. Figs. 34–38. Labra of Nomadinae. 34. *Triepeolus distinctus*. 35. *Triepeolus kathrynae*. 36. *Triepeolus epeolurus*. 37. *Pseudepeolus fasciatus*. 38. *Nomada pampicola*. Figs. 39 and 41. *Epeolus tarsalis rozenburgensis*, oblique view of head capsule. 39. Arrow pointing to lateroclypeal carina. 41. Arrow pointing to dorsal protrusion of gena. Fig. 40. *Hexepeolus rhodogyne*, arrow pointing to lateroclypeal carina. Fig. 42. *Epeolus variolosus*, arrows pointing to dorsal protrusion of gena and glabrous lobe near compound eye.

Figs. 43–45. Dorsal surfaces of pronota, scuta, and axillae. 43. *Doeringiella crassicornis*. 44. *Nomada pampicola*. 45. *Triepeolus quadrifasciatus*. Figs. 46 and 47. Axillar spines. 46. *Odyneropsis armata*. 47. *Epeolus natalensis*. Figs. 48–50. Lateral view of heads and mesosomata. 48. *Odyneropsis batesi*. 49. *Triepeolus kathrynae*. 50. *Epeolus bifasciatus*. Figs. 51–53. Forewings. 51. *Odyneropsis armata*. 52. *Thalestria spinosa*. 53. *Triepeolus quadrifasciatus*.

Figs. 54–58. Ventral view of male seventh sterna. Figs. 59–63. Ventral view of male eighth sterna. See Table 3 for species names.

Figs. 64–76. Ventral view of male seventh sterna.

Figs. 77–86. Ventral view of male seventh sterna.

Figs. 87–95. Ventral view of male seventh sterna.

Figs. 96–108. Ventral view of male eighth sterna.

Figs. 109–118. Ventral view of male eighth sterna.

Figs. 119–127. Ventral view of male eighth sterna.

Figs. 128–138. Scale bars = 1 mm, unless otherwise indicated. Fig. 128. *Triepeolus epeolurus*, male genital capsule. A. Left, dorsal view; right, ventral view. B. Lateral view. Figs. 129 and 130. Lateral view of male genital capsules. 129. *Epeolus natalensis*, arrow pointing to basal lobe of gonostylus. 130. *Brachynomada scotti*, redrawn from Rozen (1997). Figs. 131–138. Right sides of male gonocoxites, right gonostyli, and right penis valves, ventral view (setae omitted except for stout setae on gonostylus of *Odyneropsis armata*). 131. *Odyneropsis armata*, arrow pointing to inner, medial projection of penis valve. 132. *Rhogepeolus bigibbosus*. 133. *Epeolus natalensis*, arrow pointing to lateral sulcus of the gonocoxite. 134. *Thalestria spinosa*. 135. *Rhinepeolus rufiventris*, arrow pointing to ventral margin of gonocoxite. 136. *Doeringiella crassicornis*, arrow pointing to lobe on inner

surface of the gonocoxite. 137. *Pseudepeolus fasciatus*, arrow pointing to emarginate ventral margin of gonocoxite. 138. *Triepeolus tristis*.

Figs. 139–146. Dorsal view of penes. Stippling indicates sclerotization. Scale bars = 1 mm, unless otherwise indicated. 139. *Odyneropsis batesi*, arrow pointing to median sclerotized plates. 140. *Rhogepeolus biggibosus*. 141. *Epeolus mesillae*, arrow pointing to lobe on lateral margin of penis. 142. *Epeolus bifasciatus*. 143. *Thalestria spinosa*, arrow pointing to subapical lamellate projection. 144. *Rhinepeolus rufiventris*. 145. *Doeringiella crinita*, arrows pointing to medial lamellate projection and highly recurved basal part of penis valve. 146. *Triepeolus ancoratus*. Figs. 147–151. Female eighth sterna, lateral view. 147. *Odyneropsis batesi*. 148. *Rhogepeolus bigibbosus*. 149. *Epeolus cruciger*. Figs. 150 and 151. Arrows pointing to sclerotized cross bar extending from anterior ridge. 150. *Thalestria spinosa*. 151. *Triepeolus epeolurus*.

Figs. 152–165. Female seventh sterna, lateral view (lateral processes oriented toward the right). Scale bars = 0.5 mm, unless otherwise indicated. 152. *Biastes brevicornis*. 153. *Brachynomada scotti*. 154. *Hexepeolus rhodogyne*. 155. *Holcopasites calliopsidis*. 156. *Nomada pampicola*. 157. *Odyneropsis armata*. 158. *Rhogepeolus bigibbosus*. 159. *Epeolus cruciger*, arrow pointing to emarginate lateral margin. 160. *Rhinepeolus rufiventris*. 161. *Pseudepeolus fasciatus*. 162. *Thalestria spinosa*, arrow pointing to extremely elongate lateral process. 163. *Doeringiella bizonata*, arrow pointing to elongate lateral process. 164. *Triepeolus epeolurus*. 165. *Triepeolus tristis*.

Figs. 166–169. Faces of Epeolini. 166. *Odyneropsis armata*. 167. *Doeringiella crassicornis*, arrow pointing to depression on frons. 168, *Rhinepeolus rufiventris*. 169. *Epeolus tarsalis rozenburgensis*. Figs. 170 and 171. Setae of outer posterolateral corners of mesotibiae. 170. *Triepeolus quadrifasciatus*. 171. *Epeolus schummeli*.

Figs. 172 and 173. *Rhogepeolus emarginatus*. 172. Mesotibia. 173. Metatibia, arrow pointing to stout setae. Fig. 174. *Triepeolus quadrifasciatus* metatibia, detail of spine-like setae. Figs. 175–178. Posterior view of apical margins of female sixth sterna, including pygidial plates. 175. *Thalestria spinosa*. 176. *Epeolus compactus*. 177. *Rhogepeolus bigibbosus*. 178. *Doeringiella crinita*.

Figs. 179–181. Female pseudopygidial areas. 179. *Rhogepeolus biggibosus*. A. Dorsal view of T5. B. Detail of setae bordering longitudinal apical slit. 180. *Odyneropsis armata*. A. Dorsal-posterior view of T5 (posterior directed right). B. Detail of setae creating "carina" of circular depression. C. Detail of setae lateral to circular depression. 181. *Odyneropsis batesi*, dorsal-posterior view of T5.

Figs. 182–184. Female pseudopygidial areas. 182. *Thalestria spinosa*, dorsal-posterior view of T5 with S6, gonoplacs, and sting partially visible (posterior directed right). 183. *Rhinepeolus rufiventris*. A. Dorsal-posterior view of T5. B. Detail of apical longitudinal region of stout setae (posterior directed right). 184. *Pseudepeolus fasciatus*. A. Dorsal-posterior view of T5. B. Detail of medioapical setae (posterior directed right). C. Detail of setae basal on pseudopygidial area (posterior directed right).

Figs. 185–188. Female pseudopygidial areas. 185. *Doeringiella crinita*. A. Dorsal view of T5 (posterior directed right). B. Detail of setae medially on pseudopygidial area. 186. *Triepeolus distinctus*, dorsal view of T5. 187. *Triepeolus heterurus*; dorsal view of T5. 188. *Triepeolus ancoratus*. A. Dorsal view of T5 (posterior directed right). B. Detail of setae medially on pseudopygidial area.

Figs. 189–191. Female pseudopygidial areas. 189. *Triepeolus epeolurus*. A. Dorsal view of T5. B. Detail of setae basal on pseudopygidial area, adjacent to median region of flattened setae. C. Detail of flattened setae forming transverse region medially on

pseudopygidial area. 190. *Epeolus lectoides*. A. Dorsal view of T5. B. Detail of flattened setae on apical margin of pseudopygidial area. 191. *Epeolus bifasciatus*, dorsal view of pseudopygidial area.

Figs. 192 and 193. *Triepeolus antiguensis*, female, from San José, Costa Rica. 192. Dorsal habitus. 193. Pseudopygidial area. Figs. 194 and 195. *Triepeolus argyreus*, female, from Washington. 194. Dorsal habitus. 195. Pseudopygidial area. Figs. 196–199. *Triepeolus quadrifasciatus atlanticus*, females, from Alabama (Fig. 196) and North Carolina (Figs. 197–199). 196. Dorsal habitus. 197. Pseudopygidial area. 198. Face. 199. Scutum.

Figs. 200 and 201. *Triepeolus atripes*, females, from Illinois (Fig. 200) and Missouri (Fig. 201). 200. Dorsal habitus. 201. Pseudopygidial area. Figs. 202–204. *Triepeolus aztecus*, females, from Alajuela (Figs. 202 and 203) and San José (Fig. 204), Costa Rica. 202. Dorsal habitus. 203. Close-up of first and second terga. 204. Pseudopygidial area. Figs. 205–207. *Triepeolus balteatus*, female, from Colorado. 205. Dorsal habitus. 206. Pseudopygidial area. 207. Clasper-like intercoxal area.

Figs. 208 and 209. *Triepeolus brittaini*, female, from Nova Scotia, Canada. 208. Dorsal habitus. 209. Pseudopygidial area. Figs. 210 and 211. *Triepeolus californicus*, female, from California. 210. Dorsal habitus. 211. Pseudopygidial area. Figs. 212 and 213. *Triepeolus cameroni*, female, from Veracruz, Mexico. 212. Dorsal habitus. 213. Pseudopygidial area. Figs. 214 and 215. *Triepeolus concavus*, female pseudopygidial area, from California. 214. Posterior view. 215. Lateral view.

Figs. 216 and 217. *Triepeolus concavus*, female, from California. 216. Mesosoma. 217. First and second terga. Figs. 218 and 219. *Triepeolus cressonii*, females, from Kansas. 218. Dorsal habitus. 219. Pseudopygidial area. Figs. 220 and 221. *Triepeolus cuabitensis*, female, from Santiago de Cuba, Cuba. 220. Dorsal habitus. 221. Pseudopygidial area. Figs.

222 and 223. *Triepeolus dacotensis*, females, from Alberta, Canada. 222. Dorsal habitus. 223. Pseudopygidial area.

Figs. 224–227. *Triepeolus denverensis*, females, from Arizona (Figs. 224 and 227) and Utah (Figs. 225 and 226). 224–226. Dorsal habitus photographs, showing range in amount of pale setae. 227. Pseudopygidial area. Figs. 228–230. *Triepeolus distinctus*, females, from Illinois (Fig. 228) and Texas (Figs. 229 and 230). 228. Dorsal habitus. 229. Pseudopygidial area. 230. Face. Fig. 231. *Triepeolus donatus*, female, from Ohio. Face, showing relative positions of apical margin of clypeus and lower tangent of compound eye.

Figs. 232 and 233. *Triepeolus diversipes*, females, from Utah (Fig. 232) and New Mexico (Fig. 233). 232 Dorsal habitus. 233 Pseudopygidial area. Figs. 234 and 235. *Triepeolus donatus*, male from Kansas (Fig. 234) and female from Ohio (Fig. 235). 234. Dorsal habitus. 235. Pseudopygidial area. Figs. 236 and 237. *Triepeolus eldoradensis*, female, from Utah. 236. Dorsal habitus. 237. Pseudopygidial area. Figs. 238 and 239. *Triepeolus epeolurus*, female, from Jalisco, Mexico. 238. Dorsal habitus. 239. Pseudopygidial area.

Figs. 240 and 241. *Triepeolus fraserae*, females, from Utah (Fig. 240) and Arizona (Fig. 241). 240. Dorsal habitus. 241. Pseudopygidial area. Figs. 242 and 243. *Triepeolus georgicus*, female, from Florida. 242. Dorsal habitus. 243. Pseudopygidial area. Figs. 244 and 245. *Triepeolus grandis*, females, from Arizona (Fig. 244) and New Mexico (Fig. 245). 244. Dorsal habitus. 245. Pseudopygidial area. Figs. 246 and 247. *Triepeolus helianthi*, females, from California (Fig. 246) and Colorado (Fig. 247). 246. Dorsal habitus. 247. Pseudopygidial area.

Figs. 248–251. *Triepeolus heterurus*, females, from California (Figs. 248 and 249) and Baja California, Mexico (Figs. 250 and 251). 248. Dorsal habitus. 249. Pseudopygidial

area. 250. Dorsal habitus. 251. Pseudopygidial area. Figs. 252 and 253. *Triepeolus intrepidus*, female, from Arizona. 252. Dorsal habitus. 253. Pseudopygidial area. Figs. 254 and 255. *Triepeolus laticaudus*, female, from Texas. 254. Dorsal habitus. 255. Pseudopygidial area.

Figs. 256 and 257. *Triepeolus laticeps*, female, from México, Mexico. 256. Dorsal habitus. 257. Pseudopygidial area. Figs. 258 and 259. *Triepeolus loomisorum*, females, from Arizona (Fig. 258) and New Mexico (Fig. 259). 258. Dorsal habitus. 259. Pseudopygidial area. Figs. 260–263. *Triepeolus lunatus*, female, from Kansas. 260. Dorsal habitus. 261. Dorsal habitus. 262. Face. 263. Pseudopygidial area.

Figs. 264 and 265. *Triepeolus martini*, females, from Colorado. 264. Dorsal habitus. 265. Pseudopygidial area. Figs. 266 and 267. *Triepeolus medusa*, female, from Jalisco, Mexico. 266. Dorsal habitus. 267. Pseudopygidial area. Figs. 268 and 269. *Triepeolus michiganensis*, females, from New Hampshire (Fig. 268) and New York (Fig. 269). 268. Dorsal habitus. 269. Pseudopygidial area. Figs. 270 and 271. *Triepeolus micropygius*, female from Arizona. 270. Dorsal habitus. 271. Pseudopygidial area.

Fig. 272. *Triepeolus mitchelli*, holotype male, from North Carolina. Figs. 273 and 274. *Triepeolus mojavensis*, females, from California. 273. Dorsal habitus. 274. Pseudopygidial area. Figs. 275 and 276. *Triepeolus monardae*, female, from North Carolina. 275. Dorsal habitus. 276. Pseudopygidial area. Figs. 277–279. *Triepeolus nevadensis*, females, from Durango, Mexico. 277. Dorsal habitus. 278. Mesosoma. 279. Pseudopygidial area.

Figs. 280–283. *Triepeolus nigrihirtus*, female, from Texas. 280. Dorsal habitus. 281. Pseudopygidial area. 282. Face. 283. Head and mesosoma, oblique view showing preoccipital carina on posterior margin of head. Figs. 284 and 285. *Triepeolus nisibonensis*,

male, from La Altagracia, Dominican Republic. 284. Dorsal habitus. 285. Posterior margin of vertex, showing median emargination. Figs. 286 and 287. *Triepeolus norae*, females, from Arizona (Fig. 286) and New Mexico (Fig. 287). 286. Dorsal habitus. 287. Pseudopygidial area.

Figs. 288 and 289. *Triepeolus occidentalis*, females, from North Dakota (Fig. 288) and Colorado (Fig. 289). 288. Dorsal habitus. 289. Pseudopygidial area. Figs. 290–293. *Triepeolus paenepectoralis*, females, from Washington (Fig. 290), Oregon (Fig. 291), and California (Figs. 292 and 293). 290. Dorsal habitus. 291. Dorsal habitus. 292. Dorsal habitus. 293. Pseudopygidial area. Figs. 294 and 295. *Triepeolus pectoralis*, female, from North Carolina. 294. Dorsal habitus. 295. Pseudopygidial area.

Figs. 296 and 297. *Triepeolus pectoralis*, female mesepisternum, from North Carolina. 296. Lateral view. 297. Dorsal view showing long, erect, simple setae. Figs. 298–301. *Triepeolus penicilliferus*, females, from Arizona (Figs. 298, 300, and 301) and California (Fig. 299). 298. Dorsal habitus. 299. Dorsal habitus. 300. Pseudopygidial area. 301. Face. Figs. 302 and 303. *Triepeolus quadrifasciatus quadrifasciatus*, female, from Texas. 302. Dorsal habitus. 303. Pseudopygidial area.

Figs. 304–306. *Triepeolus remigatus*, female, from Arizona. 304. Dorsal habitus. 305. Mesosoma. 306. Pseudopygidial area. Figs. 307–309. *Triepeolus robustus*, female, from New Mexico. 307. Dorsal habitus. 308. Pseudopygidial area. 309. Face, oblique view showing long, erect setae surrounding clypeus. Figs. 310 and 311. *Triepeolus rohweri*, female, from Colorado. 310. Dorsal habitus. 311. Pseudopygidial area.

Figs. 312–314. *Triepeolus rufithorax*, females, from Florida. 312. Dorsal habitus. 313. Dorsal habitus. 314. Pseudopygidial area. Figs. 315 and 316. *Triepeolus rufoclypeus*, females, from Tamaulipas, Mexico (Fig. 315) and Texas (Fig. 316). 315. Dorsal habitus.

316. Pseudopygidial area. Figs. 317–319. *Triepeolus rugosus*, females, from Florida (Figs. 317 and 318) and New Jersey (Fig. 319). 317. Dorsal habitus. 318. Mesepisternum, lateral view. 319. Pseudopygidial area.

Figs. 320 and 321. *Triepeolus scelestus*, females, from Kansas. 320. Dorsal habitus. 321. Pseudopygidial area. Figs. 322 and 323. *Triepeolus subalpinus*, female, from Wyoming. 322. Dorsal habitus. 323. Pseudopygidial area. Figs. 324 and 325. *Triepeolus sublunatus*, females, from Arizona. 324. Dorsal habitus. 325. Pseudopygidial area. Figs. 326 and 327. *Triepeolus subnitens*, female, from California. 326. Dorsal habitus. 327. Pseudopygidial area.

Figs. 328 and 329. *Triepeolus tanneri*, female, from Kansas. 328. Dorsal habitus. 329. Pseudopygidial area. Figs. 330–332. *Triepeolus tepanicus*, females, from Jalisco (Figs. 330 and 332) and Colima (Fig. 331), Mexico. 330. Dorsal habitus. 331. Pseudopygidial area. 332. Mesepisternum, lateral view. Figs. 333 and 334. *Triepeolus texanus*, females, from Colorado (Fig. 333) and Washington (Fig. 334). 333. Dorsal habitus. 334. Pseudopygidial area. Fig. 335. *Triepeolus totonacus*, female dorsal habitus, from Michoacán, Mexico.

Fig. 336. *Triepeolus totonacus*, female pseudopygidial area, from Chiapas, Mexico. Figs. 337–338. *Triepeolus townsendi*, females, from Arizona (Fig. 337) and New Mexico (Fig. 338). 337. Dorsal habitus. 338. Pseudopygidial area. Figs. 339 and 340. *Triepeolus tristis*, female, from Burgenland, Austria. 339. Dorsal habitus. 340. Pseudopygidial area. Figs. 341 and 342. *Triepeolus ventralis*, female, from Chūbu, Japan. 341. Dorsal habitus. 342. Pseudopygidial area. Fig. 343. *Triepeolus vicinus*, female mesepisternum, lateral view, from Pinar del Rio, Cuba.

Figs. 344 and 345. *Triepeolus vicinus*, females, from Pinar del Rio (Fig. 344) and Havana (Fig. 345), Cuba. 344. Dorsal habitus. 345. Pseudopygidial area. Figs. 346 and 347.

Triepeolus victori, from El Seibo, Dominican Republic. 346. Dorsal habitus, male. 347. Pseudopygidial area. Figs. 348 and 349. *Triepeolus wilsoni*, female, from Pinar del Rio, Cuba. 348. Dorsal habitus. 349. Pseudopygidial area. Figs. 350 and 351. *Triepeolus zacatecus*, female, from Colima, Mexico. 350. Dorsal habitus. 351. Pseudopygidial area.

Figs. 352 and 353. *Triepeolus* species 2, female, from New Mexico. 352. Dorsal habitus. 353. Pseudopygidial area. Figs. 354 and 355. *Triepeolus* species 10, female, from Puebla, Mexico. 354. Dorsal habitus. 355. Pseudopygidial area. Figs. 356 and 357. *Triepeolus* species 11, female, from Nayarit, Mexico. 356. Dorsal habitus. 357. Pseudopygidial area. Figs. 358 and 359. *Triepeolus* species 18, females, from Texas. 358. Dorsal habitus. 359. Pseudopygidial area.

Figs. 360–362. *Triepeolus* species 19, female, from Jalisco (Figs. 360 and 362) and Morelos (Fig. 361), Mexico. 360. Dorsal habitus. 361. Pseudopygidial area. 362. Mesepisternum, lateral view. Figs. 363 and 364. *Triepeolus* species 37, female, from Texas. 363. Dorsal habitus. 364. Pseudopygidial area. Figs. 365 and 366. *Triepeolus* species 39, females, from Nevada (Fig. 365) and Arizona (Fig. 366). 365. Dorsal habitus. 366. Pseudopygidial area. Fig. 367. *Triepeolus* species 42, female dorsal habitus, from California.

Fig. 368. *Triepeolus* species 42, female pseudopygidial area, from California. Figs. 369 and 370. *Triepeolus* species 43, female, from Puebla, Mexico. 369. Dorsal habitus. 370. Pseudopygidial area. Figs. 371–373. *Triepeolus* species 44, female, from New Mexico. 371. Dorsal habitus. 372. Metasoma, dorsal view. 373. Pseudopygidial area. Figs. 374 and 375. *Triepeolus* species 49, female, from Puebla, Mexico. 374. Dorsal habitus. 375. Pseudopygidial area.

Figs. 376 and 377. *Triepeolus* species 51, females, from Nevada (Fig. 376) and Utah (Fig. 377). 376. Dorsal habitus. 377. Pseudopygidial area. Figs. 378 and 379. *Triepeolus*

species 59, females, from Colorado (Fig. 378) and Utah (Fig. 379). 378. Dorsal habitus. 379. Pseudopygidial area. Figs. 380 and 381. *Triepeolus* species 60, females, from Arizona. 380. Dorsal habitus. 381. Pseudopygidial area. Figs. 382 and 383. *Triepeolus* species 61, female, from Texas. 382. Dorsal habitus. 383. Pseudopygidial area.

Figs. 384 and 385. *Triepeolus* species 62, female, from Hidalgo, Mexico. 384. Dorsal habitus. 385. Pseudopygidial area. Figs. 386 and 387. *Triepeolus* species 63, females, from New Mexico. 386. Dorsal habitus. 387. Pseudopygidial area. Figs. 388 and 389. *Triepeolus* species 65, females, from Arizona. 388. Dorsal habitus. 389. Pseudopygidial area. Figs. 390 and 391. *Triepeolus* species 74, females, from Arizona. 390. Dorsal habitus. 391. Pseudopygidial area.

Figs. 392 and 393. *Triepeolus* species 76, females, from North Dakota (Fig. 392) and Utah (Fig. 393). 392. Dorsal habitus. 393. Pseudopygidial area. Figs. 394 and 395. *Triepeolus* species 78, female, from California. 394. Dorsal habitus. 395. Pseudopygidial area. Figs. 396 and 397. *Triepeolus* species 80, female, from Texas. 396. Dorsal habitus. 397. Pseudopygidial area. Figs. 398 and 399. *Triepeolus* species 81, females, from Durango (Fig. 398) and Chihuahua (Fig. 399), Mexico. 398. Dorsal habitus. 399. Pseudopygidial area.

Figs. 400–402. *Triepeolus* species 90, female, from California. 400. Dorsal habitus. 401. Pseudopygidial area. 402. Mesosoma, showing pattern of setae on scutellum. Figs. 403 and 404. *Triepeolus* species 92, female, from New Mexico. 403. Dorsal habitus. 404. Pseudopygidial area. Figs. 405 and 406. *Triepeolus* species 95, females, from New Mexico (Fig. 405) and Arizona (Fig. 406). 405. Dorsal habitus. 406. Pseudopygidial area. Fig. 407. *Triepeolus* species 97, female dorsal habitus, from Texas.

Fig. 408. *Triepeolus* species 97, female pseudopygidial area, from Texas. Figs. 409 and 410. *Triepeolus* species 110, females, from Arizona (Fig. 409) and Sinaloa, Mexico (Fig. 410). 409. Dorsal habitus. 410. Pseudopygidial area. Figs. 411–413. *Triepeolus* species 134, females, from California. 411. Dorsal habitus. 412. Dorsal habitus. 413. Pseudopygidial area. Figs. 414 and 415. *Triepeolus* species 141, female, from Michoacán, Mexico. 414. Dorsal habitus. 415. Pseudopygidial area.

Figs. 416 and 417. *Triepeolus* species 142, female, from Guanacaste, Costa Rica. 416. Dorsal habitus. 417. Pseudopygidial area. Figs. 418 and 419. *Triepeolus* species 143, female, from California. 418. Dorsal habitus. 419. Pseudopygidial area. Figs. 420 and 421. *Triepeolus* species 144, female, from California. 420. Dorsal habitus. 421. Pseudopygidial area. Figs. 422 and 423. *Triepeolus* species 170, female, from California. 422. Dorsal habitus. 423. Pseudopygidial area.

Figs. 424 and 425. *Triepeolus* species 174, females, from Utah. 424. Dorsal habitus. 425. Pseudopygidial area. Figs. 426 and 427. *Triepeolus* species 177, female, from Coahuila, Mexico. 426. Dorsal habitus. 427. Pseudopygidial area. Figs. 428 and 429. *Triepeolus* species 179, females, from New Mexico. 428. Dorsal habitus. 429. Pseudopygidial area. Figs. 430 and 431. *Triepeolus kathrynae*, females, from Arizona. 430. Dorsal habitus. 431. Pseudopygidial area.

Figs. 432 and 433. *Triepeolus mexicanus*, female, from Jalisco (Fig. 432) and San Luis Potosí (Fig. 433), Mexico. 432. Dorsal habitus. 433. Pseudopygidial area. Figs. 434 and 435. *Triepeolus obliteratus*, female, from North Carolina. 434. Dorsal habitus. 435. Pseudopygidial area. Figs. 436 and 437. *Triepeolus rhododontus*, female, from South Carolina. 436. Dorsal habitus. 437. Pseudopygidial area. Figs. 438 and 439. *Triepeolus roni*, female, from Havana, Cuba. 438. Dorsal habitus. 439. Pseudopygidial area.

Figs. 440 and 441. *Triepeolus simplex*, females, from Texas (Fig. 440) and Kansas (Fig. 441). 440. Dorsal habitus. 441. Pseudopygidial area. Figs. 442 and 443. *Triepeolus atoconganus*, female, from Lima, Peru. 442. Dorsal habitus. 443. Pseudopygidial area. Figs. 444 and 445. *Triepeolus bilineatus*, females, from Alta Verapaz, Guatemala (Fig. 444) and Jalisco, Mexico (Fig. 445). 444. Dorsal habitus. 445. Pseudopygidial area. Figs. 446 and 447. *Triepeolus buchwaldi*, female, from Cajamarca, Peru. 446. Dorsal habitus. 447. Pseudopygidial area.

Figs. 448 and 449. *Triepeolus osiriformis*, female, from São Paulo, Brazil. 448. Dorsal habitus. 449. Pseudopygidial area. Figs. 450 and 451. *Triepeolus rufotegularis*, female, from Magdalena, Colombia. 450. Dorsal habitus. 451. Pseudopygidial area. Figs. 452 and 453. *Triepeolus verbesinae*, female, from Baja California Sur, Mexico. 452. Dorsal habitus. 453. Pseudopygidial area. Figs. 454 and 455. *Triepeolus* species 101, female, from Ontario, Canada. 454. Dorsal habitus. 455. Pseudopygidial area.

Fig. 456. *Triepeolus* species 169, male dorsal habitus, from Lara, Venezuela. Figs. 457 and 458. *Triepeolus* species 172, female, from California. 457. Dorsal habitus. 458. Pseudopygidial area. Figs. 459–463. Clypeus illustrations, showing relative sizes of punctures and glabrous midline (Figs 461–463, restricted dorsally in Fig. 462). 459. *Triepeolus distinctus* (from holotype of *Triepeolus pimarum*). 460. *Triepeolus distinctus* (from holotype of *Triepeolus mesillae*). 461. *Triepeolus rufithorax*. 462. *Triepeolus subnitens*. 463. *Triepeolus martini*.

Figs. 464–469. Female sterna 5, ventral views (A), and terga 5, dorsal views (B). 464. *Triepeolus donatus*. 465. *Triepeolus buchwaldi*. 466. *Triepeolus osiriformis*. 467. *Triepeolus verbesinae*. 468. *Triepeolus penicilliferus*. 469. *Triepeolus concavus*. Figs. 470

and 471. *Triepeolus grandis*, male metasoma, showing apical fringes of setae on S3–5. 470. Ventral view. 471. Lateral view.

Figs. 472–477. Female metasomata, dorsal views. 472. *Triepeolus cressonii*. 473. *Triepeolus dacotensis*. 474 and 475. *Triepeolus distinctus*, showing variation in pattern of pale setae on T1. 476. *Triepeolus donatus*. 477. *Triepeolus eldoradensis*.

Figs. 478–483. Female metasomata, dorsal views. 478. *Triepeolus grandis*. 479. *Triepeolus lunatus*. 480. *Triepeolus martini*. 481. *Triepeolus mexicanus*. 482. *Triepeolus mojavensis*. 483. *Triepeolus occidentalis*.

Figs. 484–489. Female metasomata, dorsal views. 484. *Triepeolus remigatus*. 485. *Triepeolus tristis*. 486. *Triepeolus verbesinae*. 487. *Triepeolus* species 134. 488. *Triepeolus* sp., in the *T. verbesinae* species group. 489. *Triepeolus* sp., in the *T. verbesinae* species group.

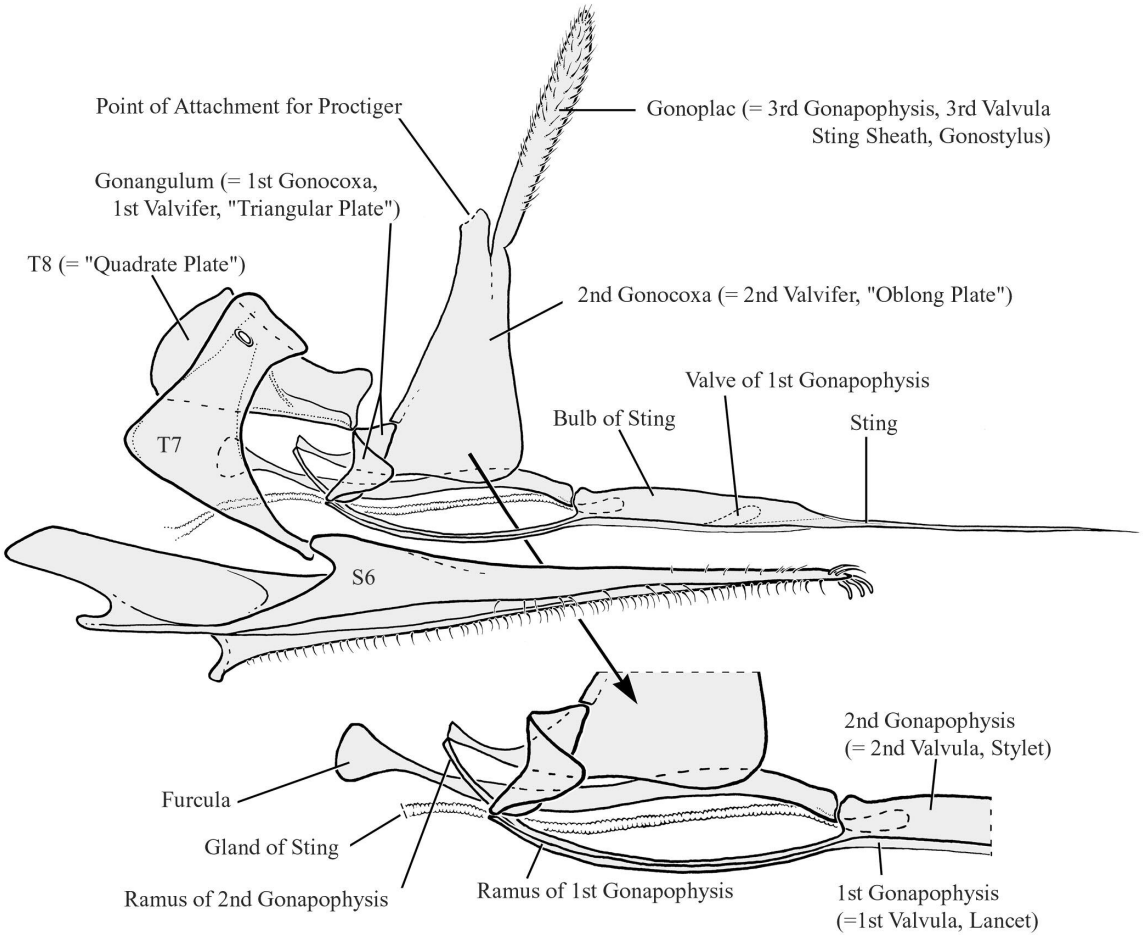
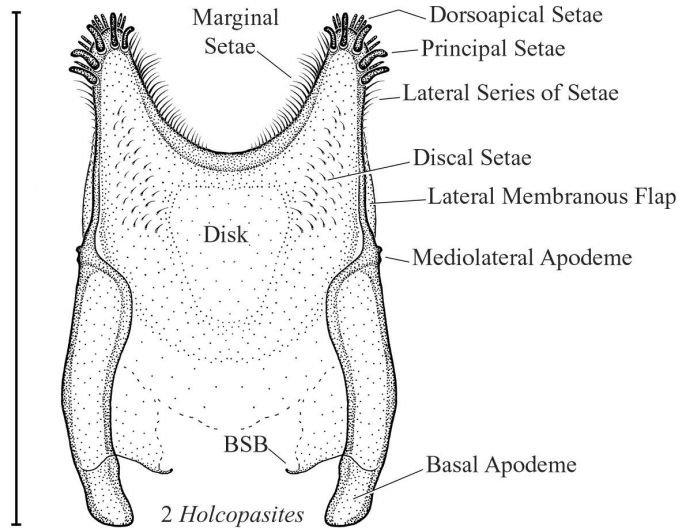
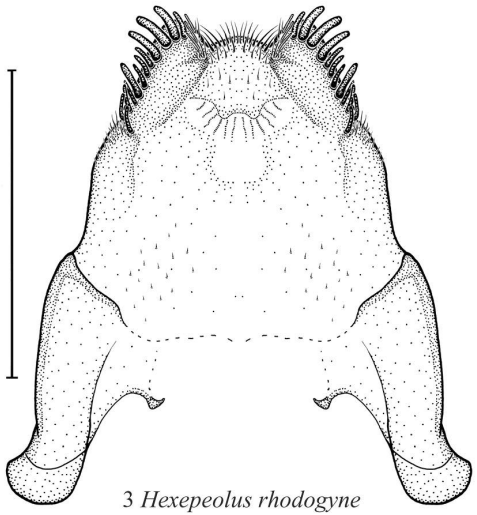

Point of Attachment for Proctiger
Gonoplac (= 3rd Gonapophysis, 3rd Valvula
Sting Sheath, Gonostylus)
Gonangulum (= 1st Gonocoxa,
1st Valvifer, "Triangular Plate")
T8 (= "Quadrate Plate")
2nd Gonocoxa (= 2nd Valvifer, "Oblong Plate")
Valve of 1st Gonapophysis
Bulb of Sting
Sting
T7
S6
2nd Gonapophysis
(= 2nd Valvula, Stylet)
Furcula
Gland of Sting
Ramus of 2nd Gonapophysis
Ramus of 1st Gonapophysis
1st Gonapophysis
(=1st Valvula, Lancet)

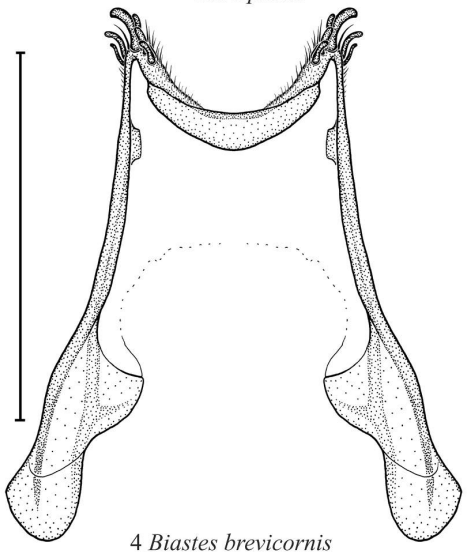
Figure 1.



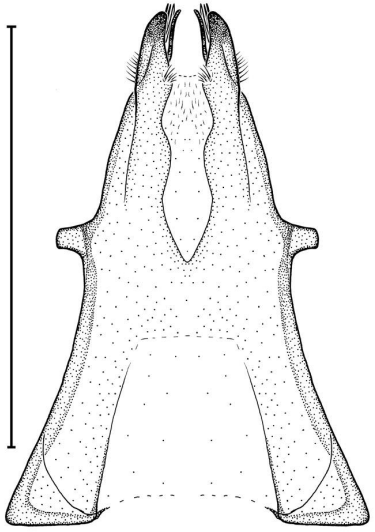
2 *Holcopasites calliopsidis*



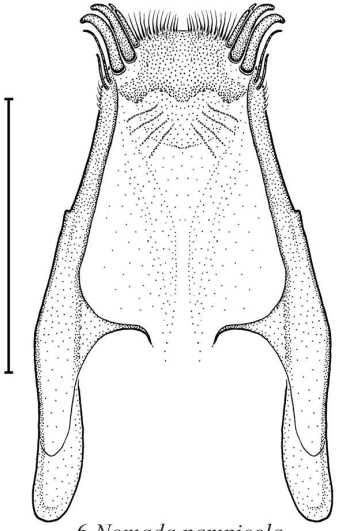
3 *Hexepeolus rhodogyne*



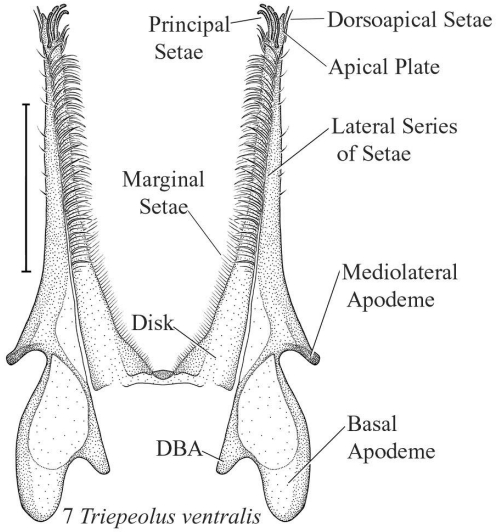
4 *Biastes brevicornis*



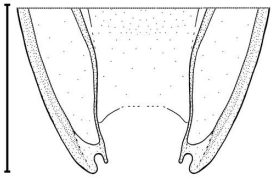
5 *Brachynomada scotti*



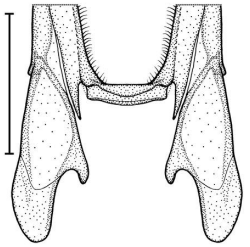
6 *Nomada pampicola*



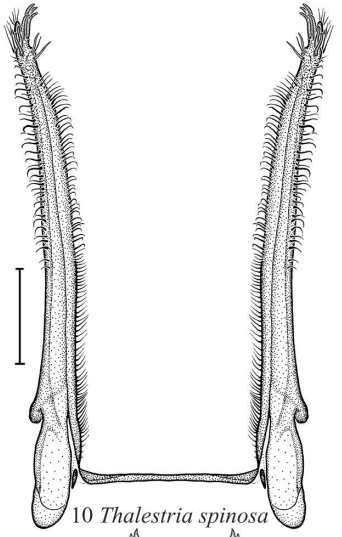
7 *Triepeolus ventralis*



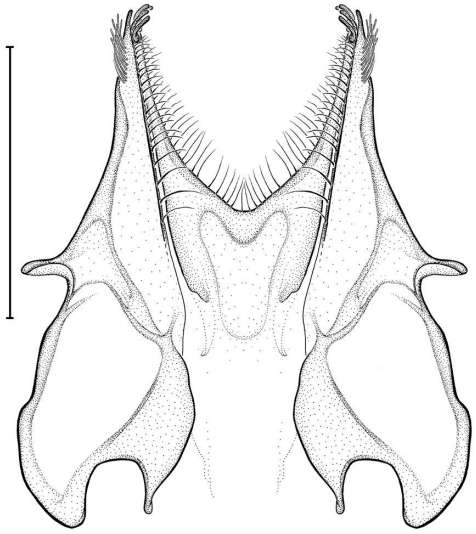
8 *Epeolus lectoides*



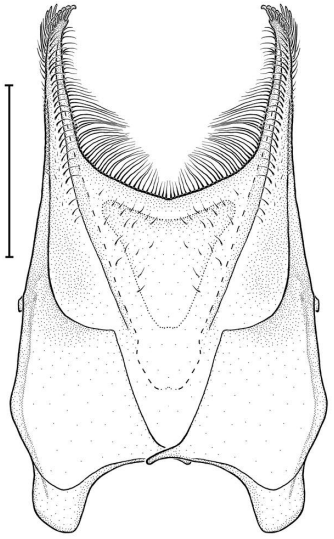
9 *Triepeolus vicinus*



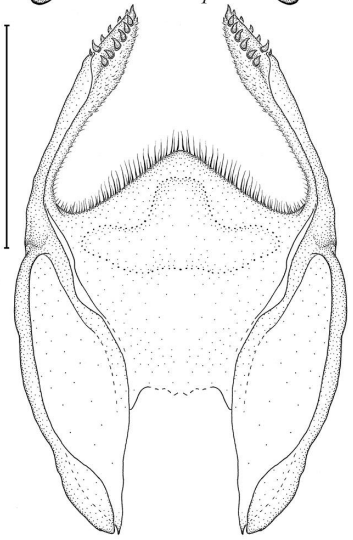
10 *Thalestria spinosa*



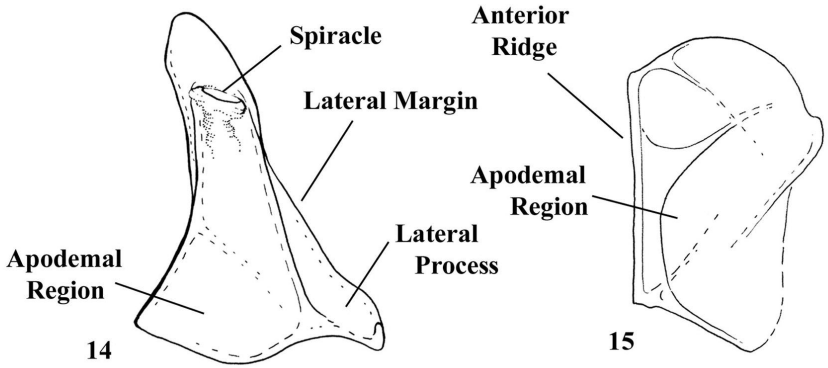
11 *Rhogepeolus emarginatus*

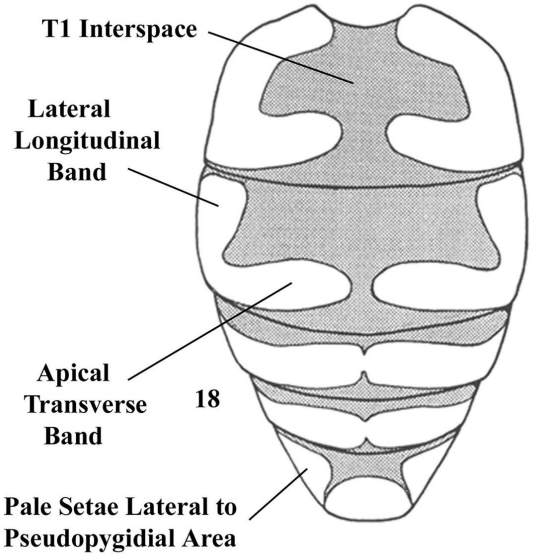


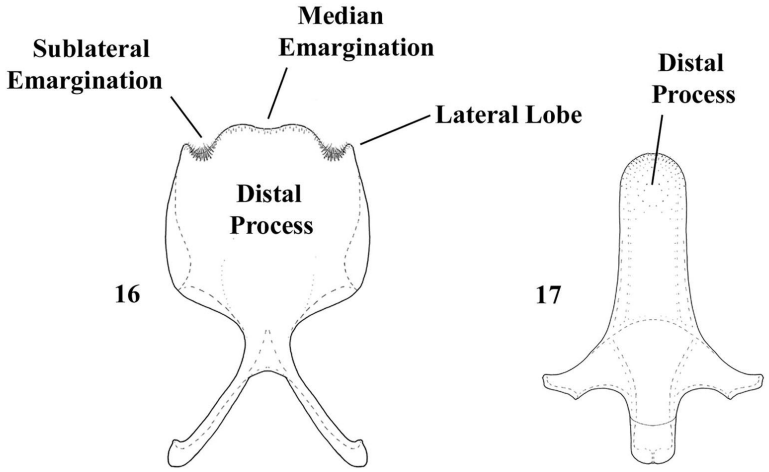
12 *Odyneropsis armata*

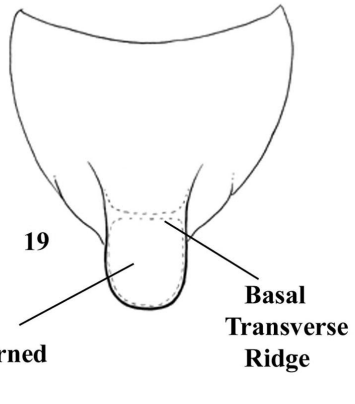


13 *Epeolus schummeli*


Spiracle
Lateral Margin
Lateral Process
Apodemal Region
14
Anterior Ridge
Apodemal Region
15


T1 Interspace
Lateral Longitudinal Band
Apical Transverse Band
18
Pale Setae Lateral to Pseudopygidial Area


Sublateral Emargination
Median Emargination
Lateral Lobe
Distal Process
16
Distal Process
17


19
Apical Downturned Plate
Basal Transverse Ridge

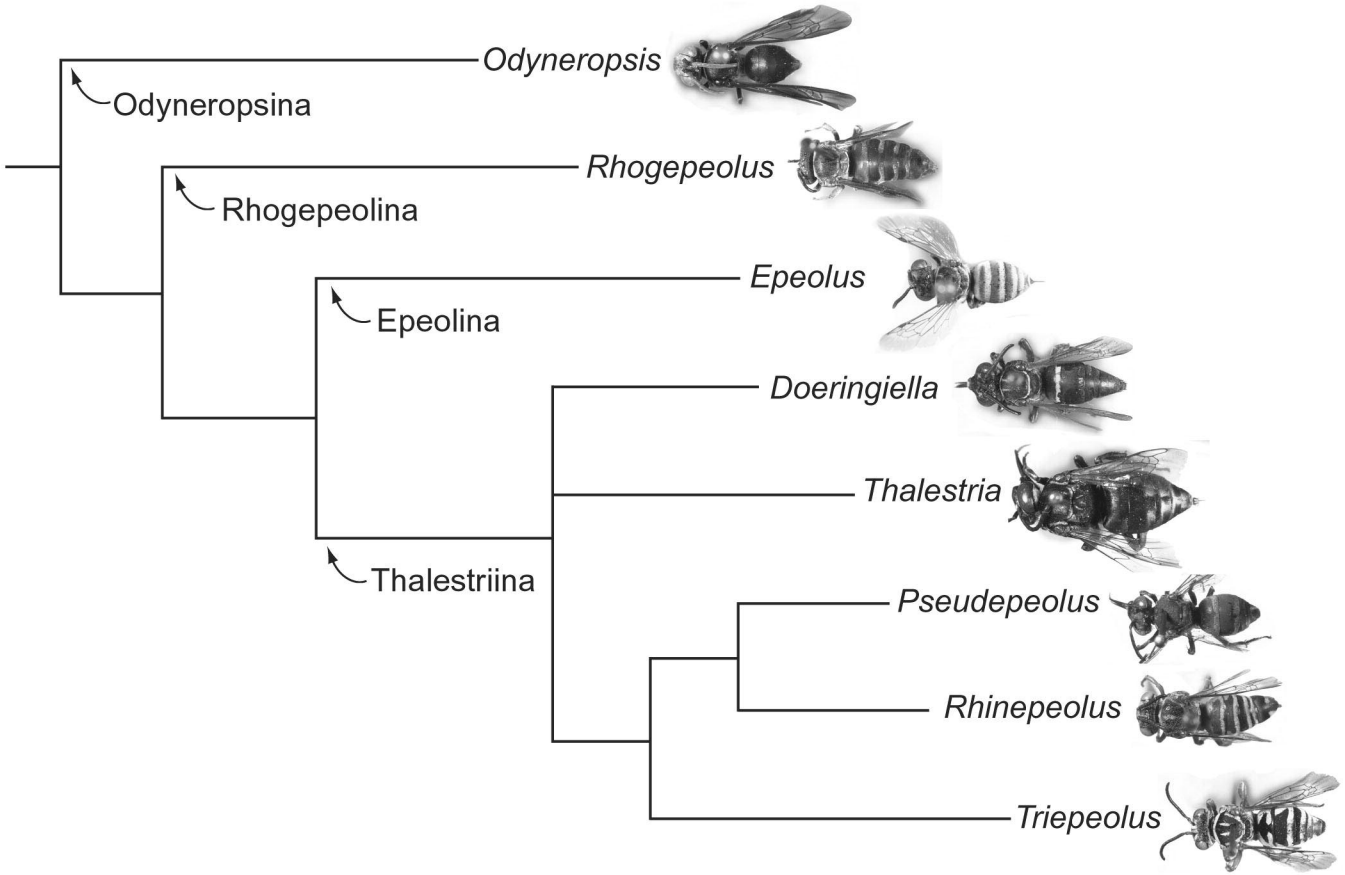
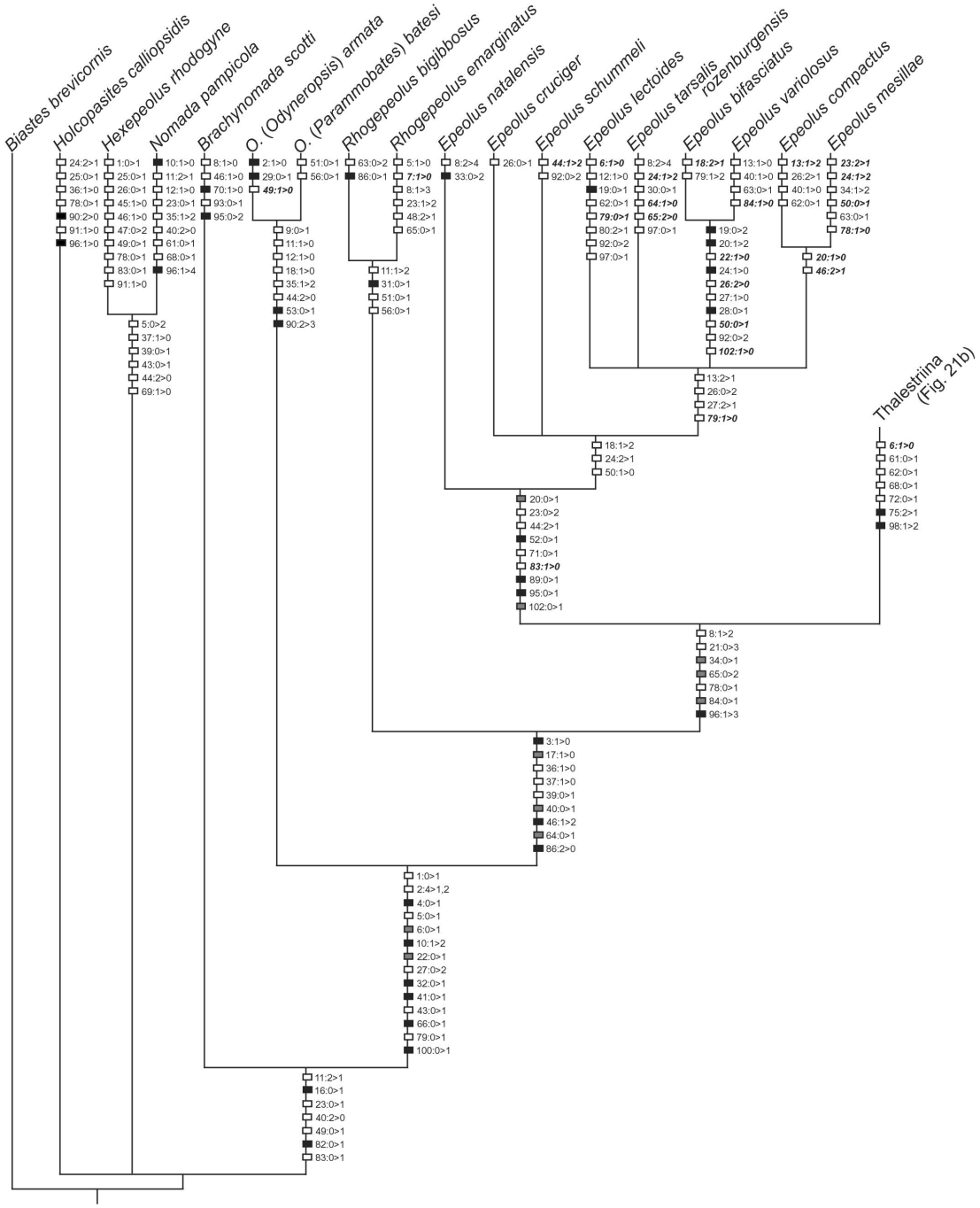
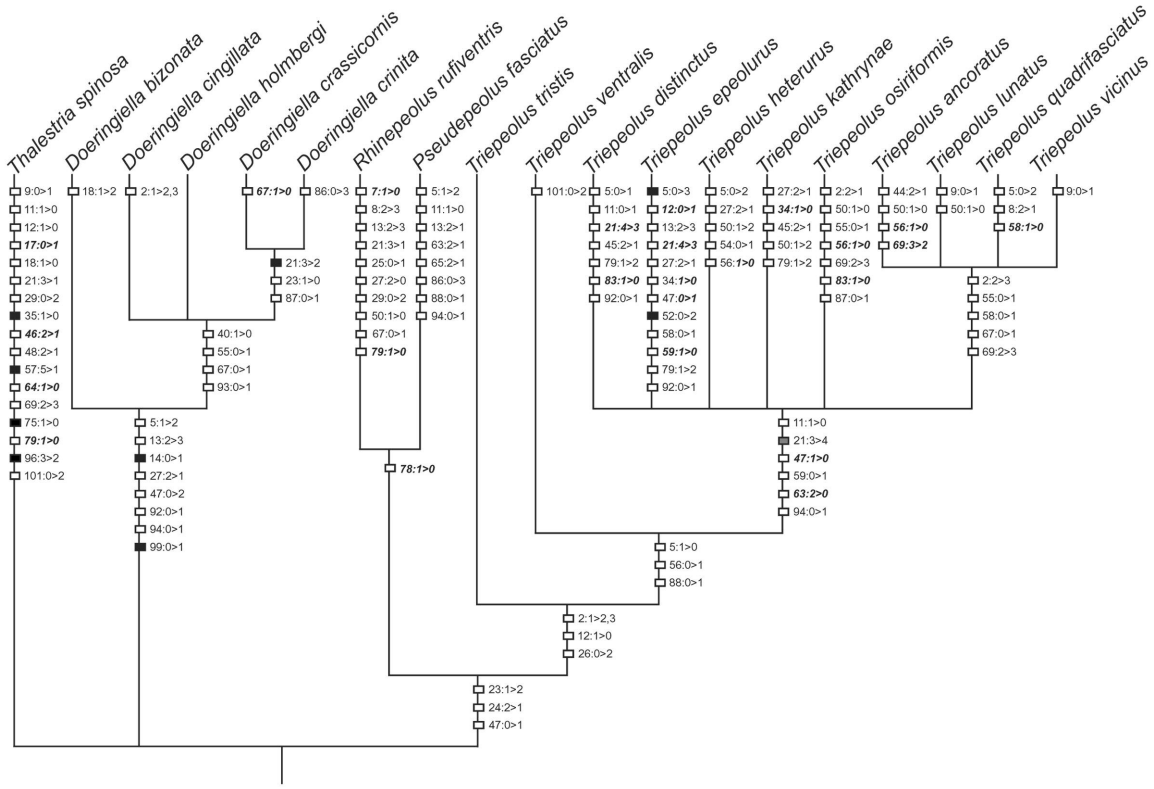

Odyneropsis
Odyneropsina
Rhogepeolus
Rhogepeolina
Epeolus
Epeolina
Doeringiella
Thalestria
Thalestriina
Pseudepeolus
Rhinepeolus
Triepeolus

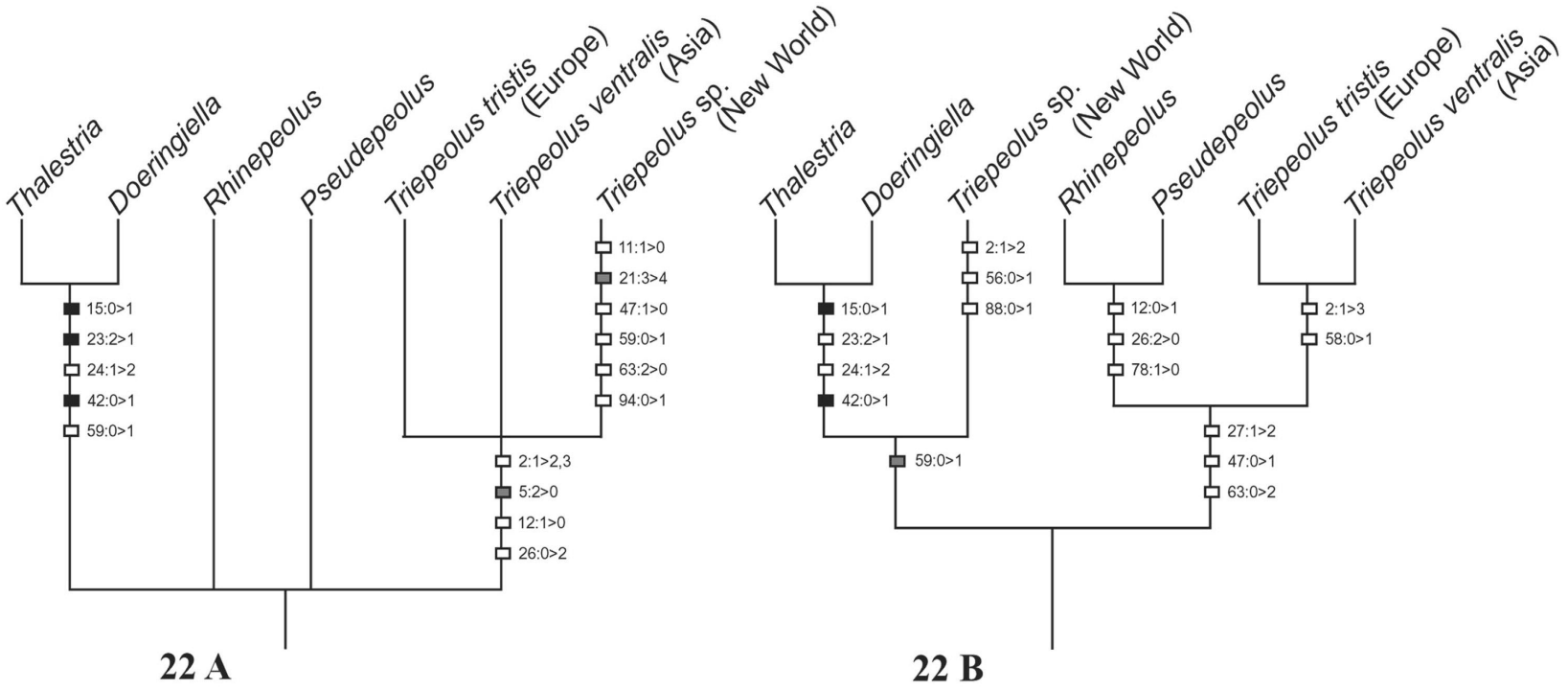
Figure 20

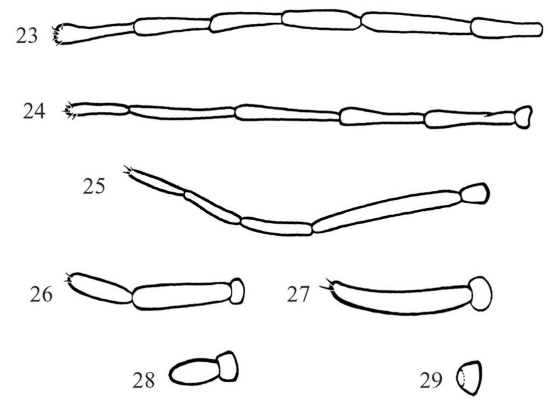


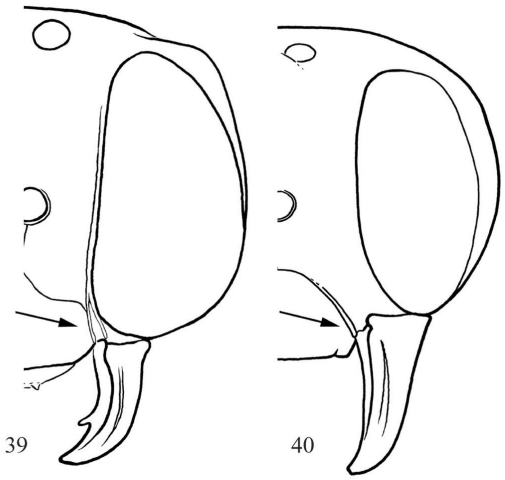
21A. See supplementary file for higher resolution image.

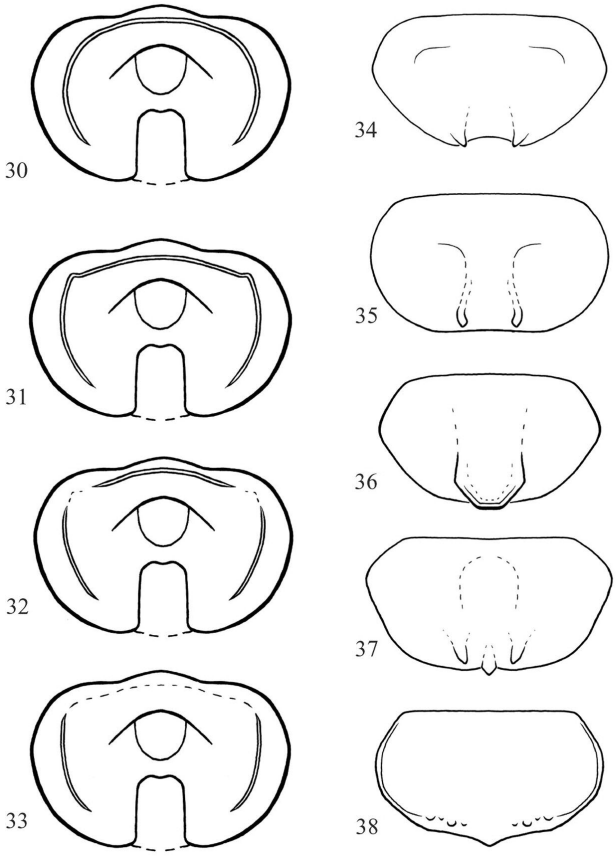


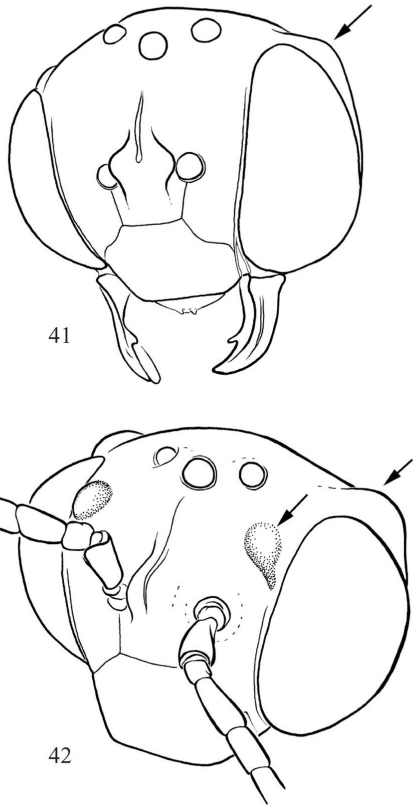
21B. See supplementary file for higher resolution image.

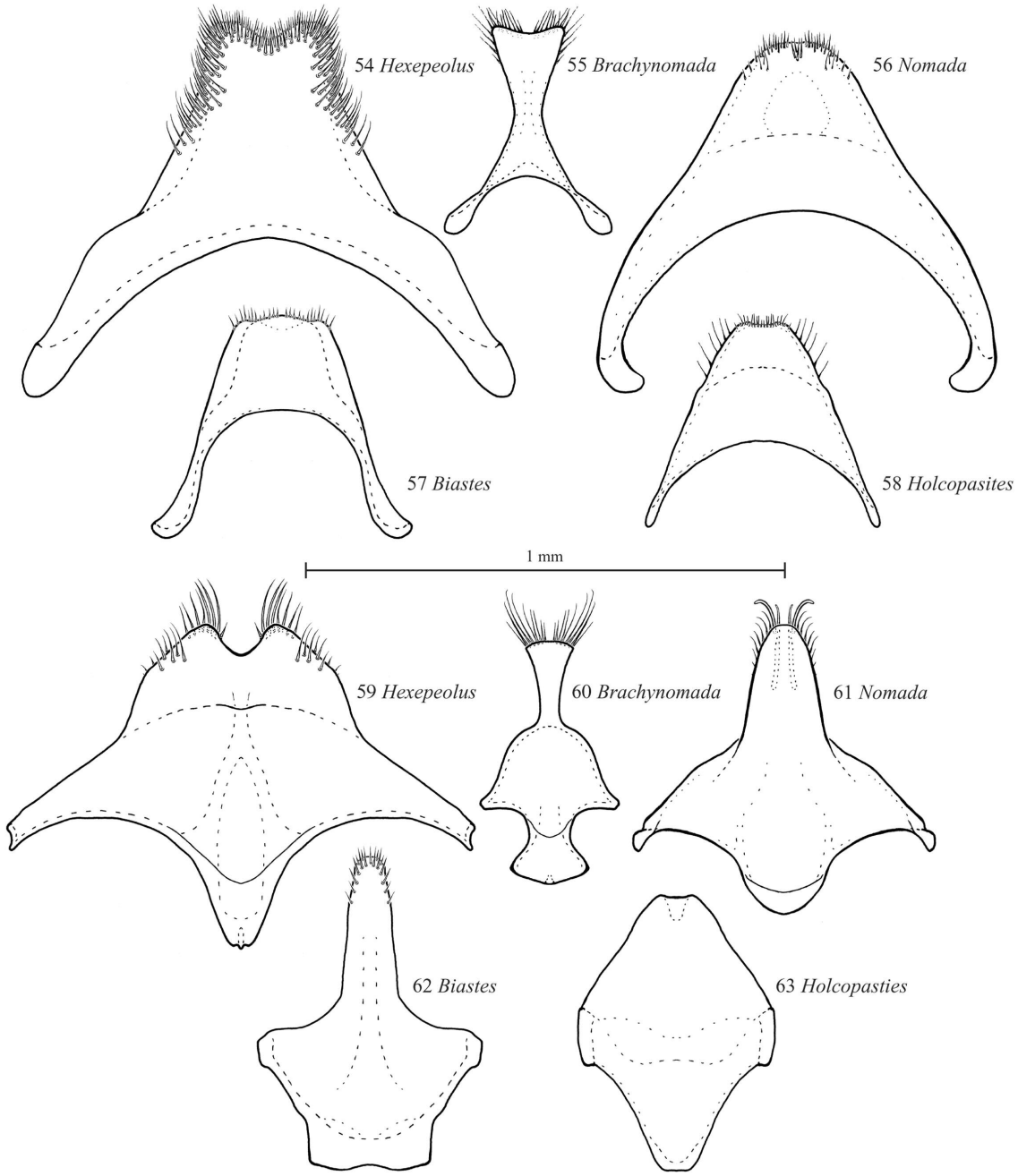

Thalestria
Doeringiella
Rhinepeolus
Pseudepeolus
Triepeolus tristis (Europe)
Triepeolus ventralis (Asia)
Triepeolus sp. (New World)
15:0>1
23:2>1
24:1>2
42:0>1
59:0>1
11:1>0
21:3>4
47:1>0
59:0>1
63:2>0
94:0>1
2:1>2,3
5:2>0
12:1>0
26:0>2
22 A
Thalestria
Doeringiella
Triepeolus sp. (New World)
Rhinepeolus
Pseudepeolus
Triepeolus tristis (Europe)
Triepeolus ventralis (Asia)
15:0>1
23:2>1
24:1>2
42:0>1
2:1>2
56:0>1
88:0>1
59:0>1
12:0>1
26:2>0
78:1>0
2:1>3
58:0>1
27:1>2
47:0>1
63:0>2
22 B

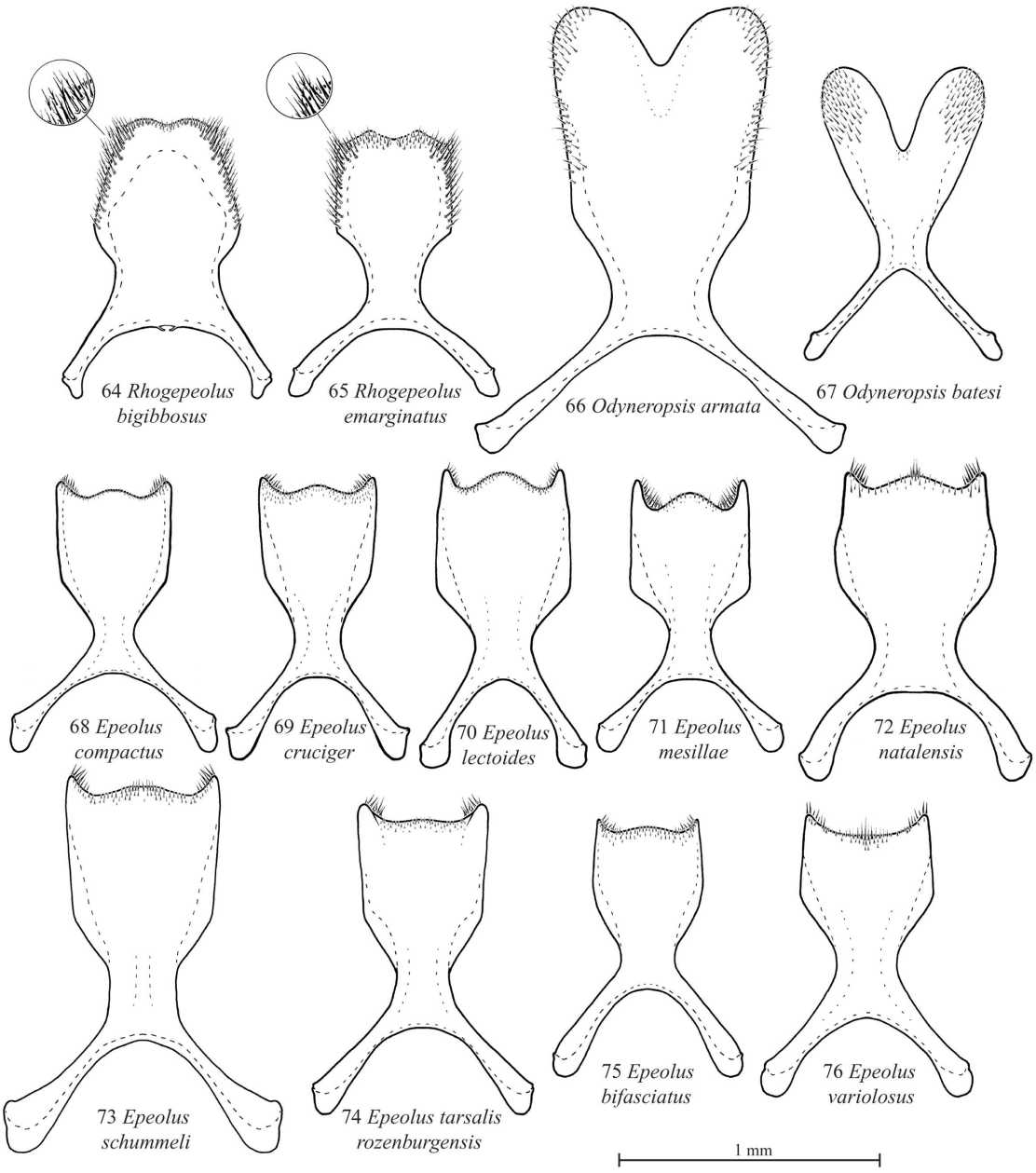

23
24
25
26
27
28
29

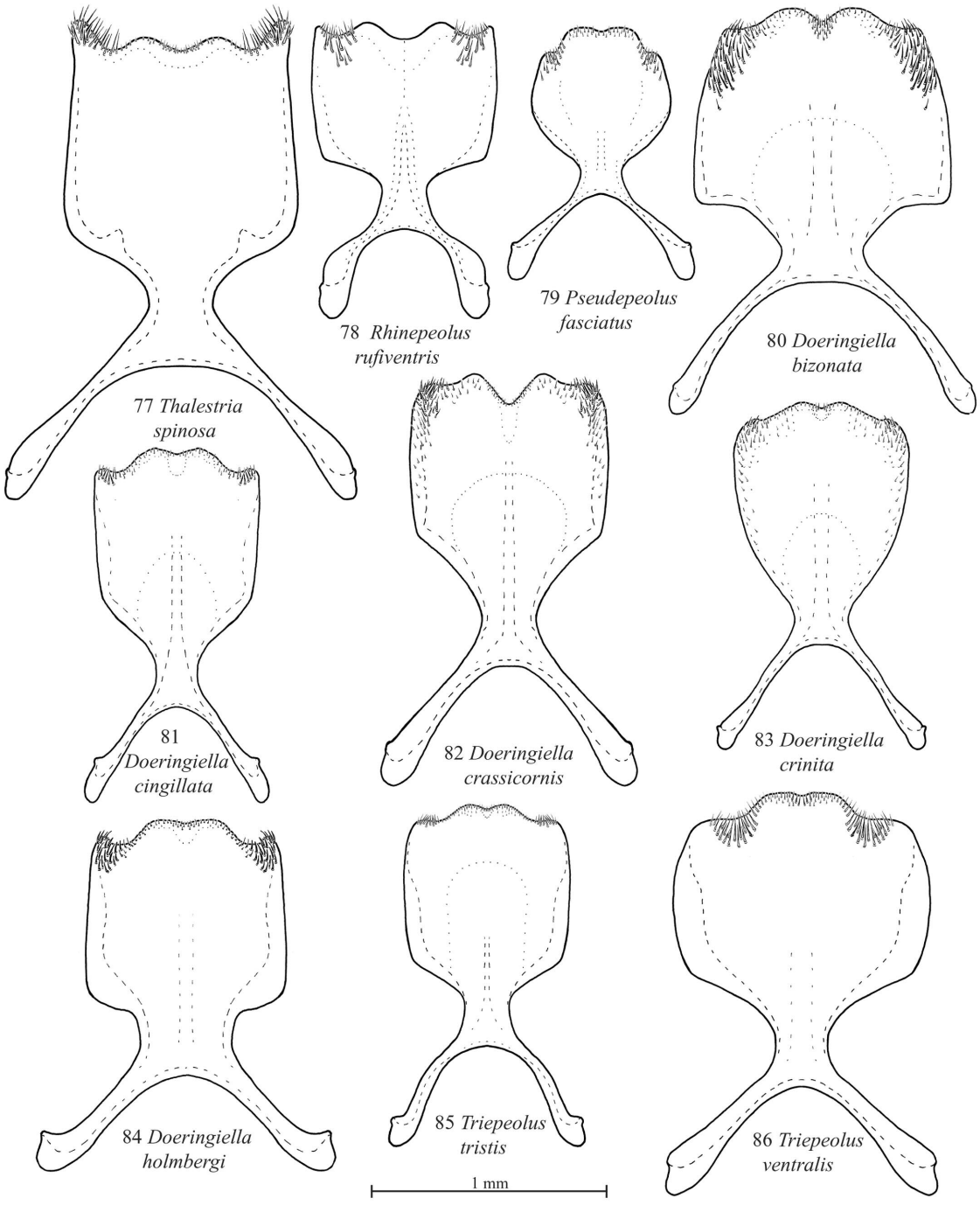

39
40

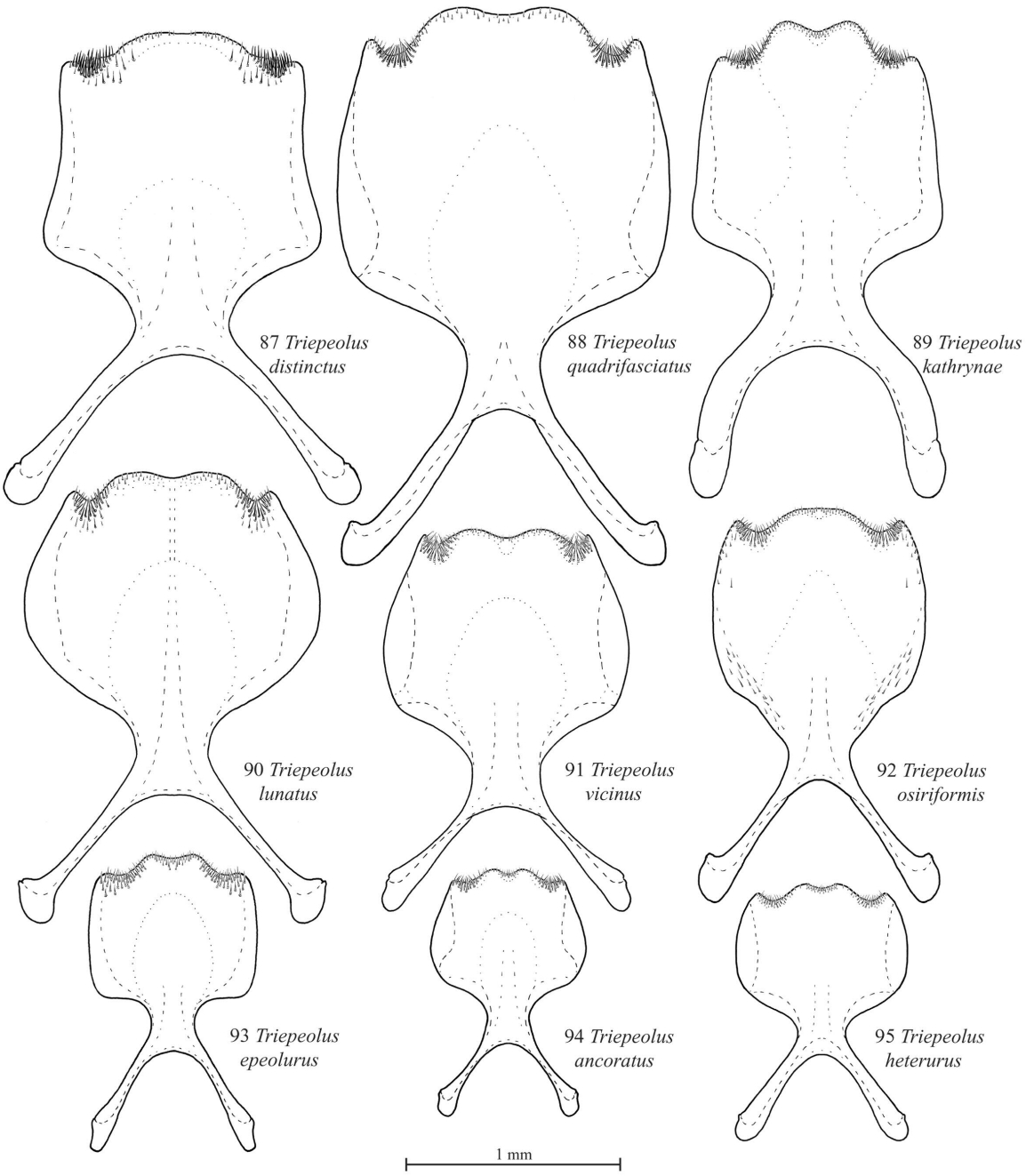

30
31
32
33
34
35
36
37
38

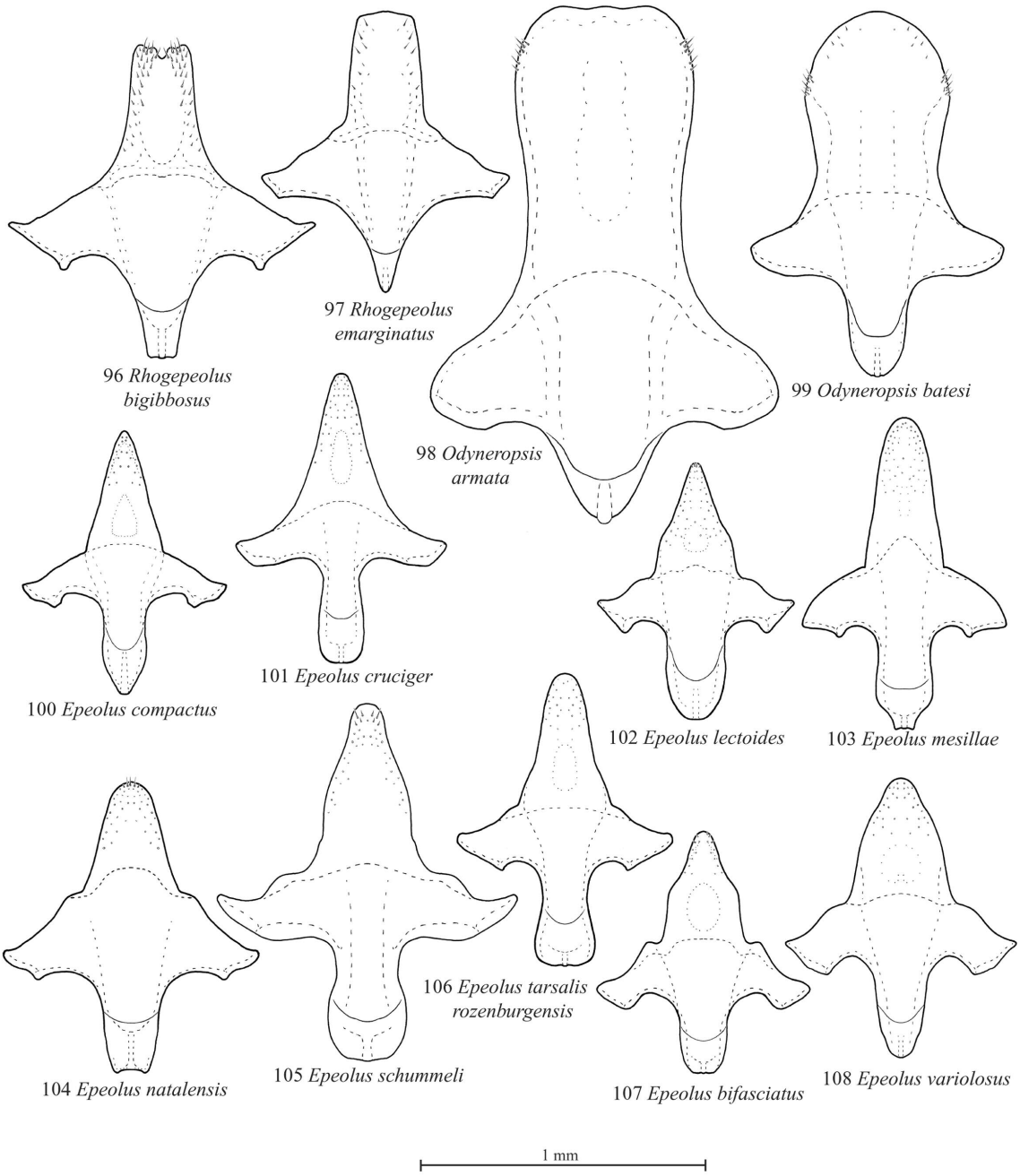

41
42

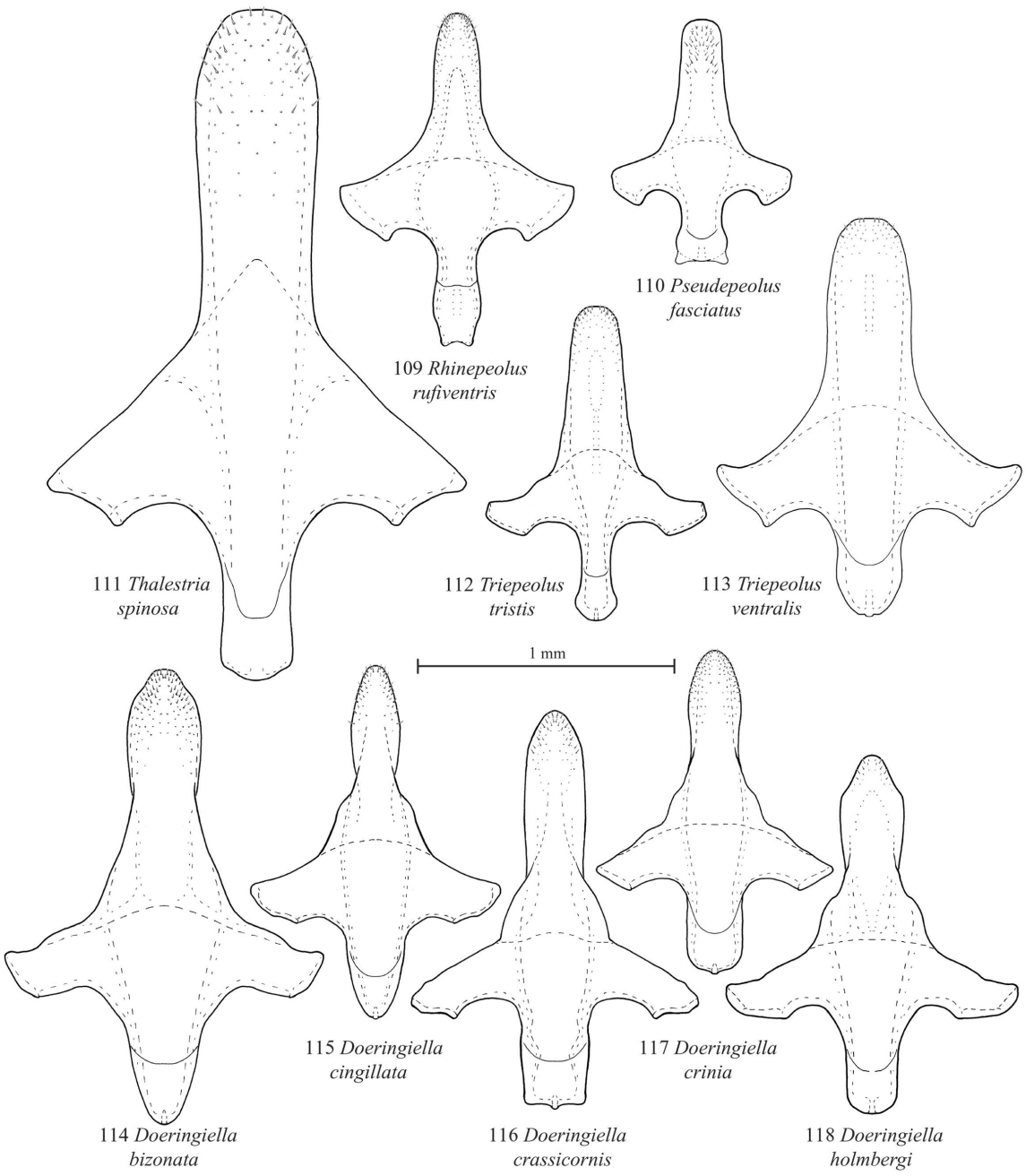

54 Hexepeolus
55 Brachynomada
56 Nomada
57 Biastes
58 Holcopasites
1 mm
59 Hexepeolus
60 Brachynomada
61 Nomada
62 Biastes
63 Holcopasties

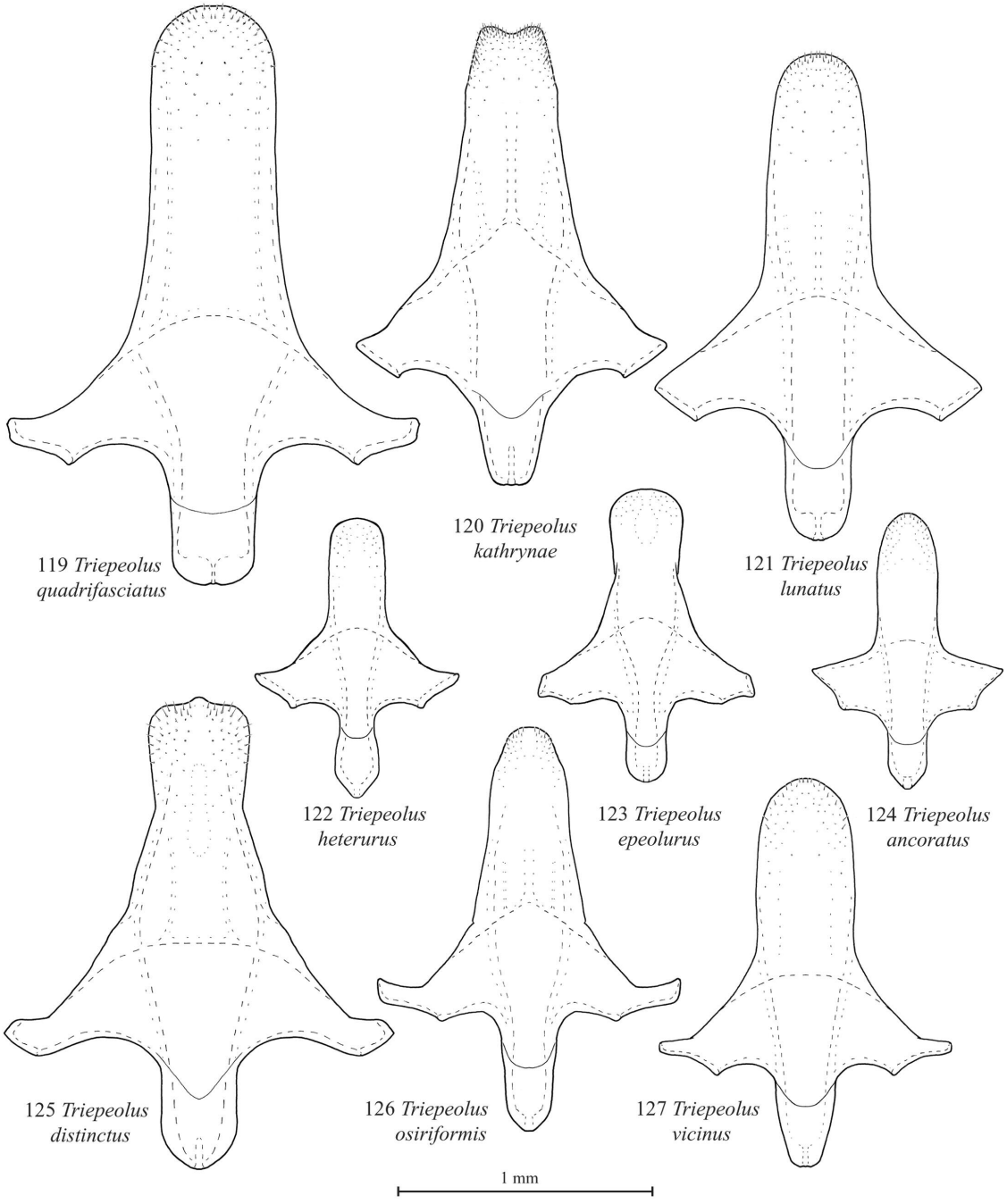

64 *Rhogepeolus bigibbosus*
65 *Rhogepeolus emarginatus*
66 *Odyneropsis armata*
67 *Odyneropsis batesi*
68 *Epeolus compactus*
69 *Epeolus cruciger*
70 *Epeolus lectoides*
71 *Epeolus mesillae*
72 *Epeolus natalensis*
73 *Epeolus schummeli*
74 *Epeolus tarsalis rozenburgensis*
75 *Epeolus bifasciatus*
76 *Epeolus variolosus*
1 mm

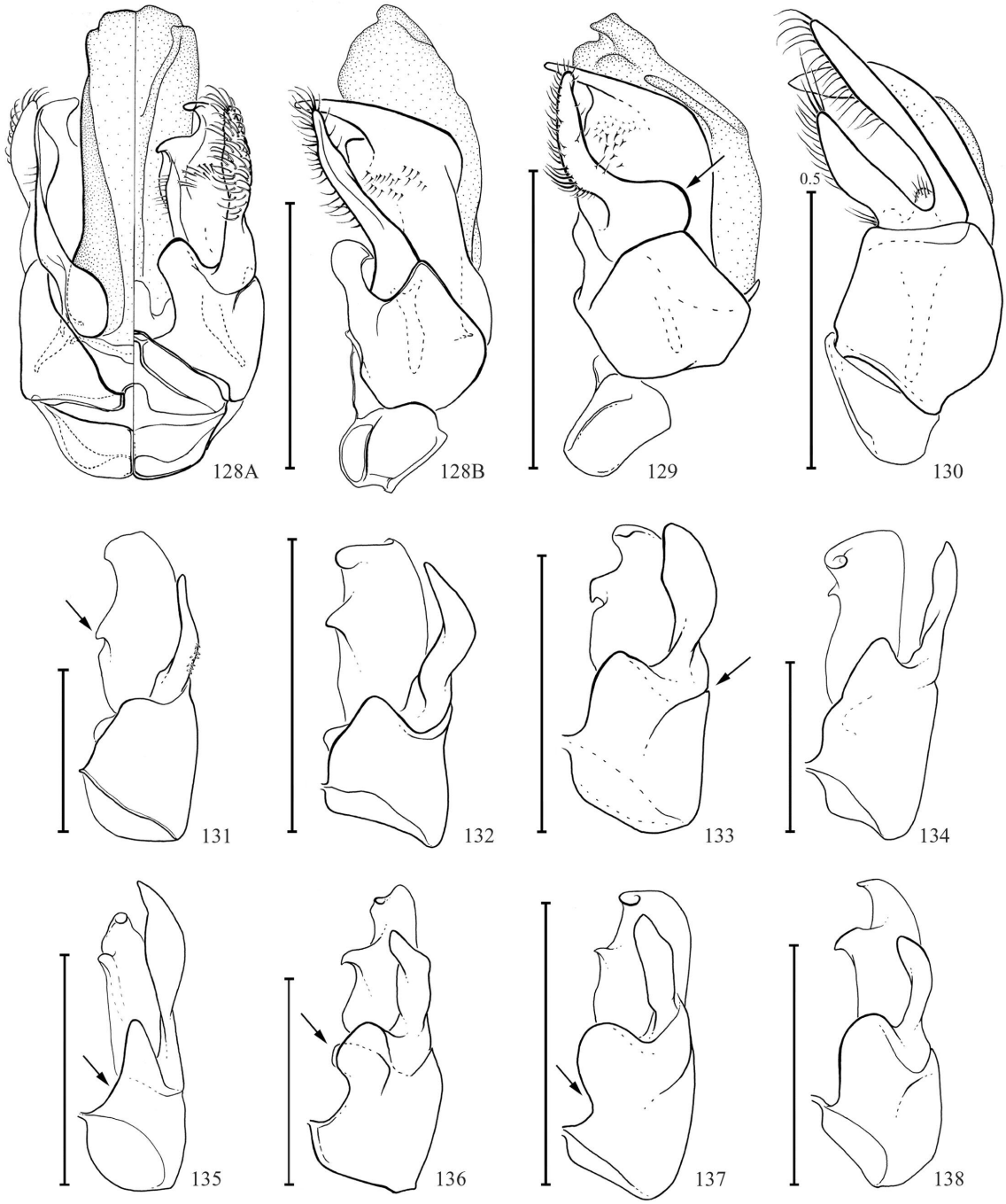

77 Thalestria spinosa
78 Rhinepeolus rufiventris
79 Pseudepeolus fasciatus
80 Doeringiella bizonata
81 Doeringiella cingillata
82 Doeringiella crassicornis
83 Doeringiella crinita
84 Doeringiella holmbergi
85 Triepeolus tristis
86 Triepeolus ventralis
1 mm

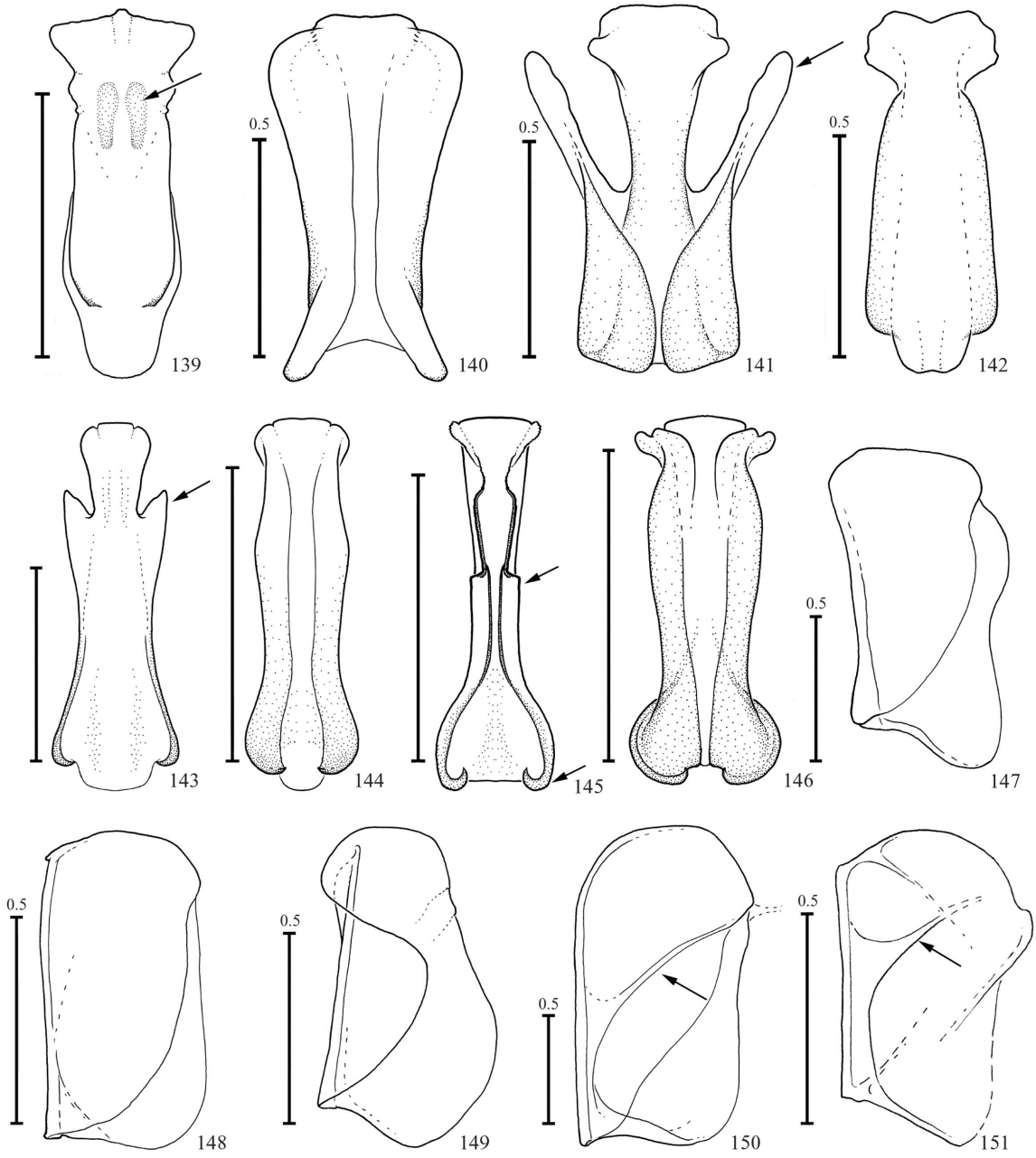

87 *Triepeolus distinctus*
88 *Triepeolus quadrifasciatus*
89 *Triepeolus kathrynae*
90 *Triepeolus lunatus*
91 *Triepeolus vicinus*
92 *Triepeolus osiriformis*
93 *Triepeolus epeolurus*
94 *Triepeolus ancoratus*
95 *Triepeolus heterurus*
1 mm

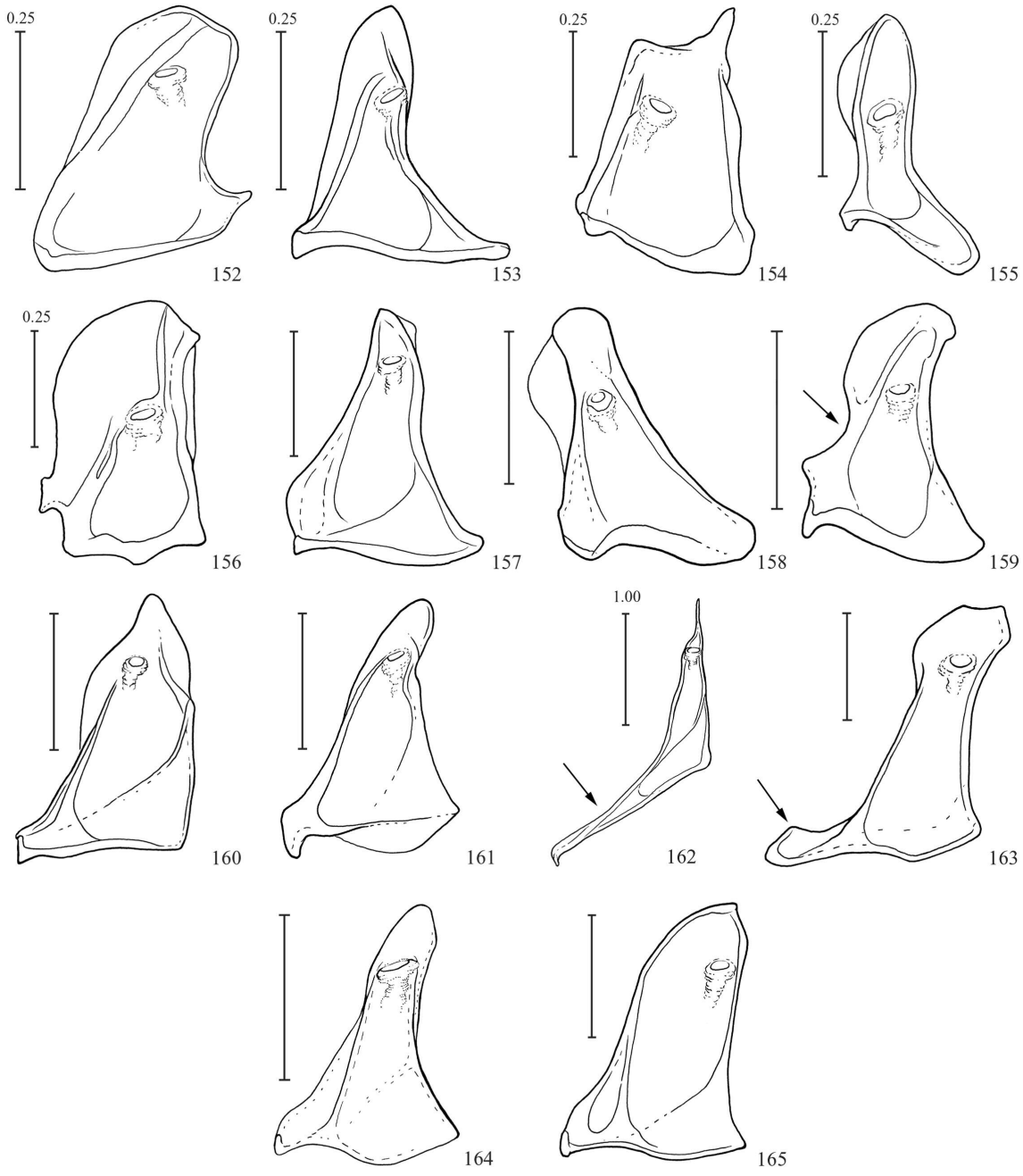

96 Rhogepeolus bigibbosus
97 Rhogepeolus emarginatus
98 Odyneropsis armata
99 Odyneropsis batesi
100 Epeolus compactus
101 Epeolus cruciger
102 Epeolus lectoides
103 Epeolus mesillae
104 Epeolus natalensis
105 Epeolus schummeli
106 Epeolus tarsalis rozenburgensis
107 Epeolus bifasciatus
108 Epeolus variolosus
1 mm

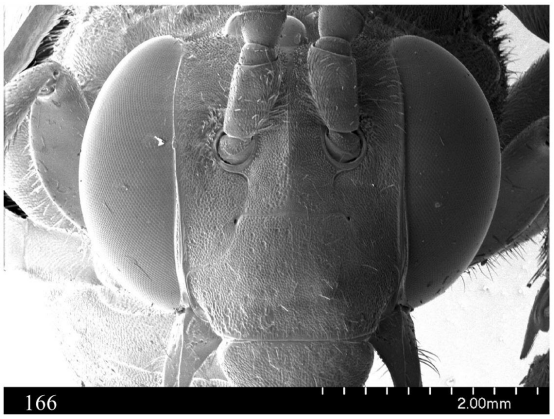

109 *Rhinepeolus rufiventris*
110 *Pseudepeolus fasciatus*
111 *Thalestria spinosa*
112 *Triepeolus tristis*
113 *Triepeolus ventralis*
1 mm
114 *Doeringiella bizonata*
115 *Doeringiella cingillata*
116 *Doeringiella crassicornis*
117 *Doeringiella crinia*
118 *Doeringiella holmbergi*

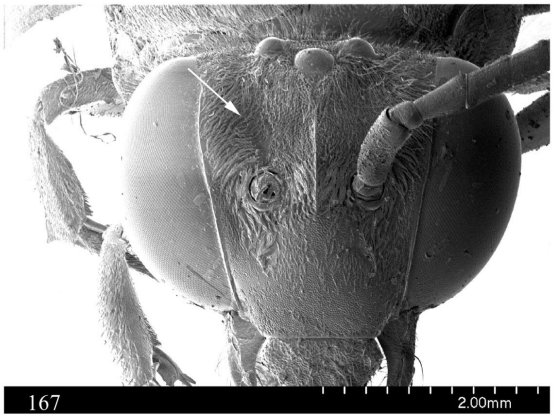

119 *Triepeolus quadrifasciatus*
120 *Triepeolus kathrynae*
121 *Triepeolus lunatus*
122 *Triepeolus heterurus*
123 *Triepeolus epeolurus*
124 *Triepeolus ancoratus*
125 *Triepeolus distinctus*
126 *Triepeolus osiriformis*
127 *Triepeolus vicinus*
1 mm

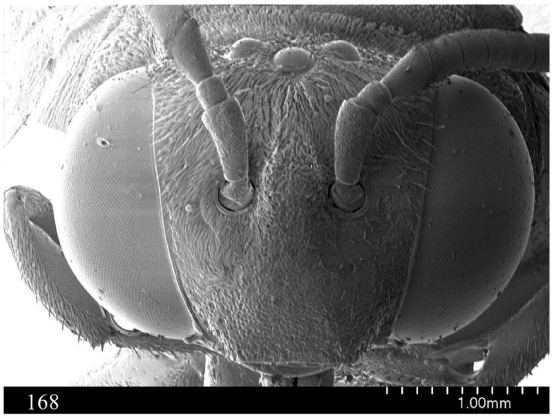

128A
128B
129
0.5
130
131
132
133
134
135
136
137
138

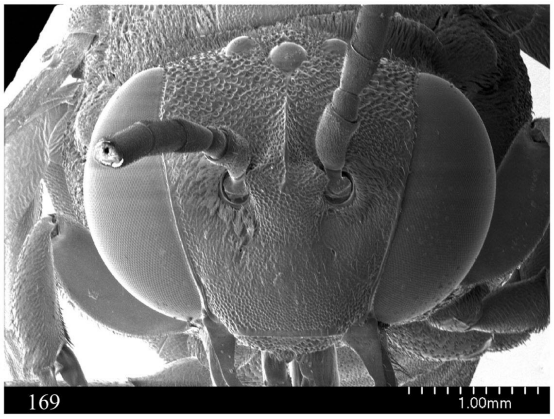

0.5
139
140
141
142
143
144
145
146
147
148
149
150
151

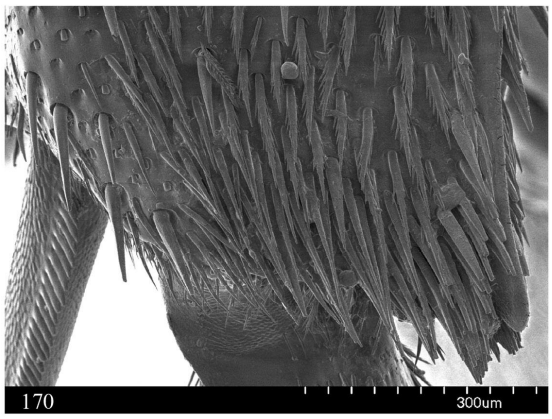

0.25
152
0.25
153
0.25
154
0.25
155
0.25
156
157
158
159
160
161
1.00
162
163
164
165

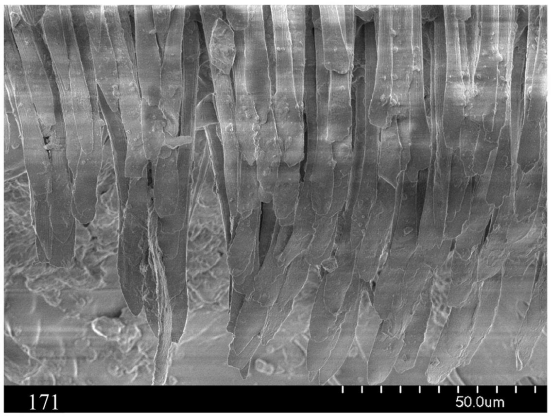

166
2.00mm

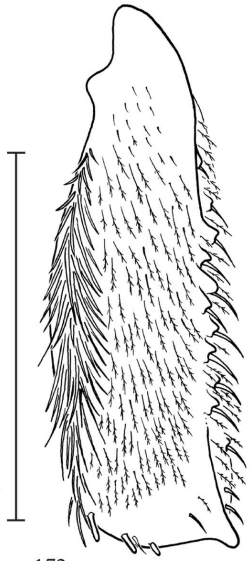

167
2.00mm


168
1.00mm

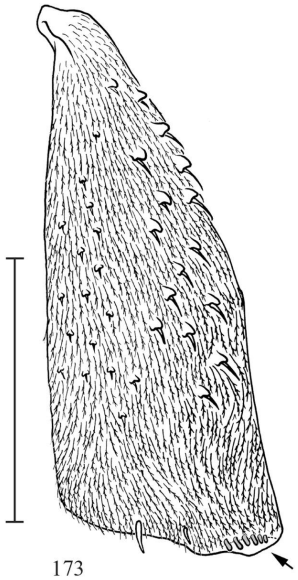

169
1.00mm


170
300um

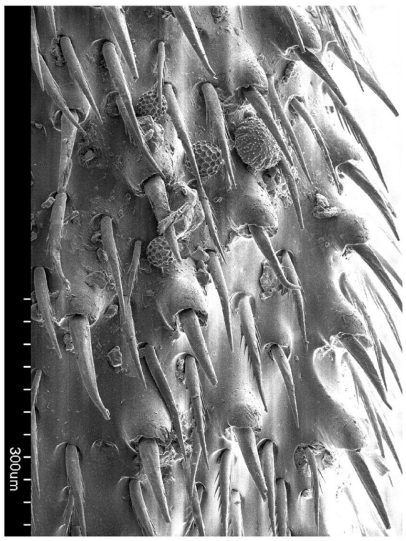

171
50.0um



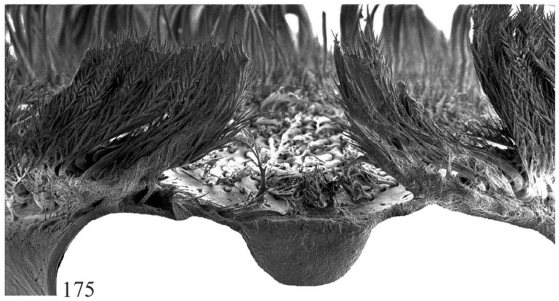
172



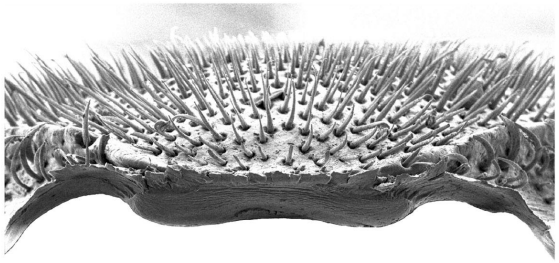
173



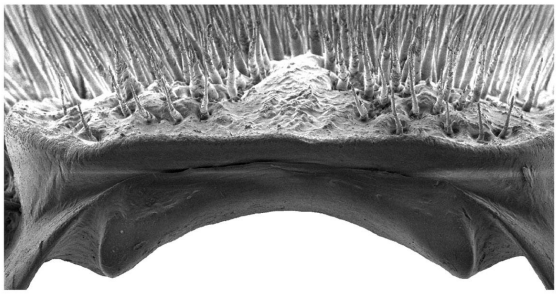
174



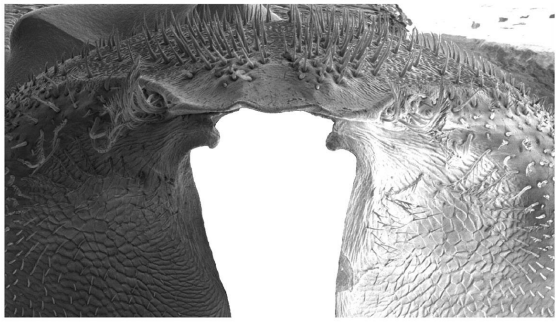
175



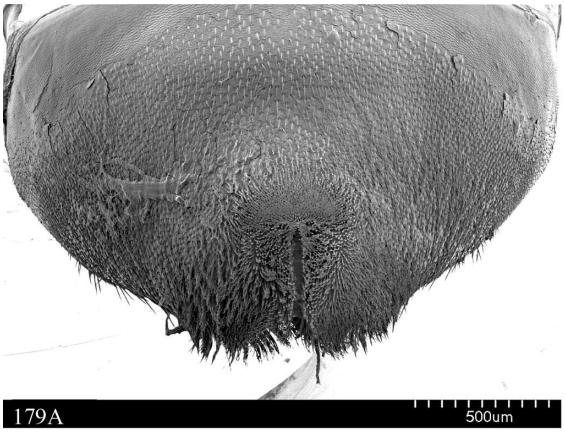
176

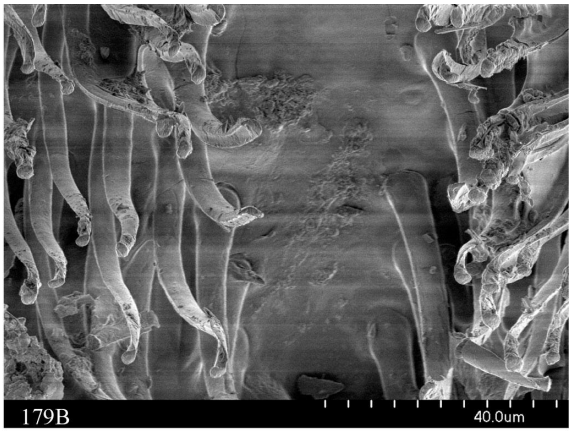


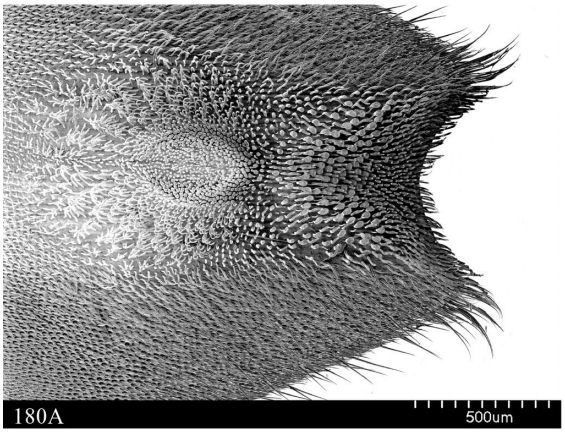
177

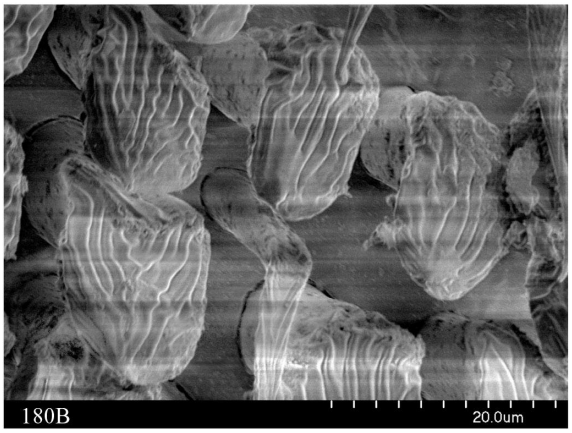


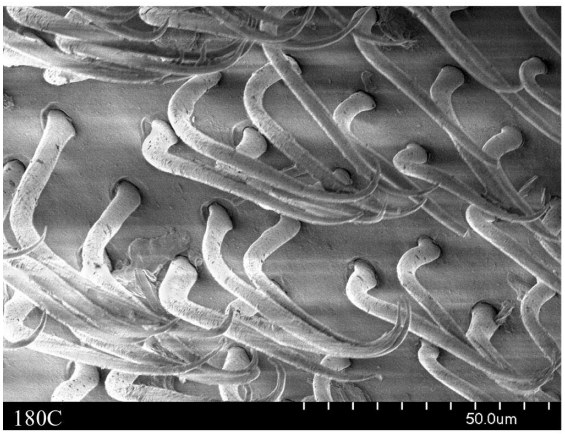
178

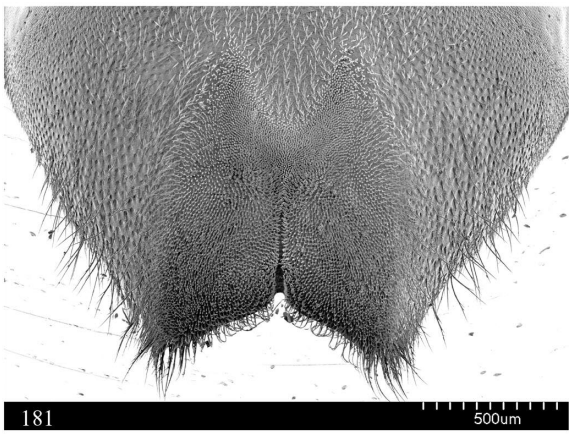

179A
500um

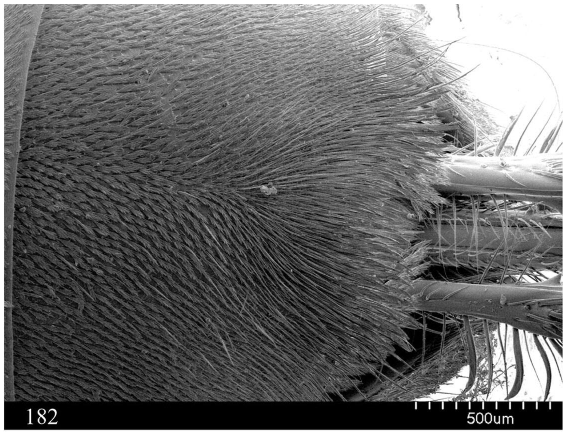

179B
40.0um

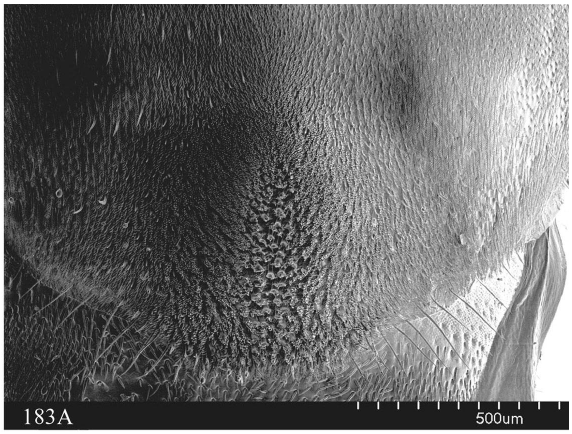

180A
500um

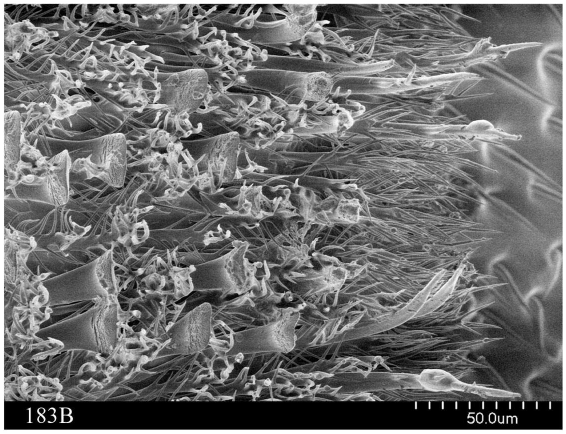

180B
20.0um

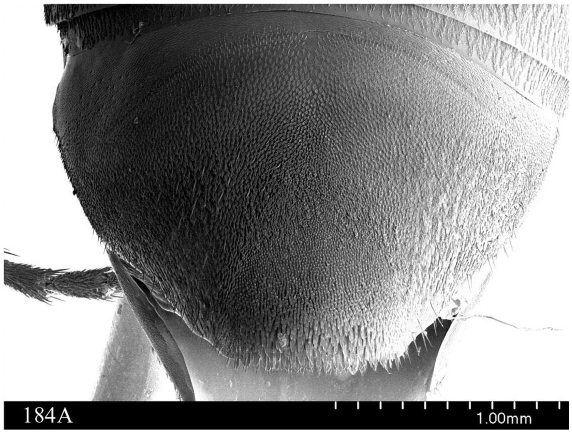

180C
50.0um

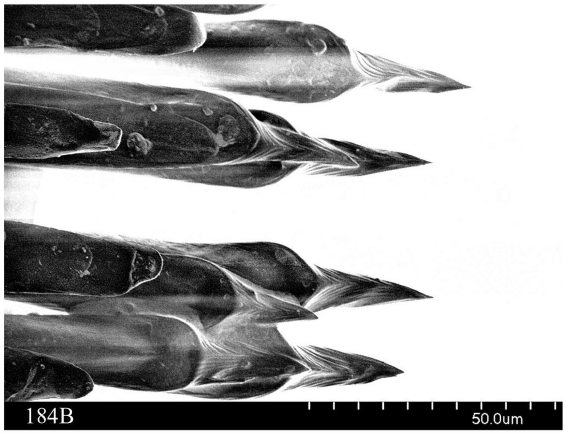

181
500um

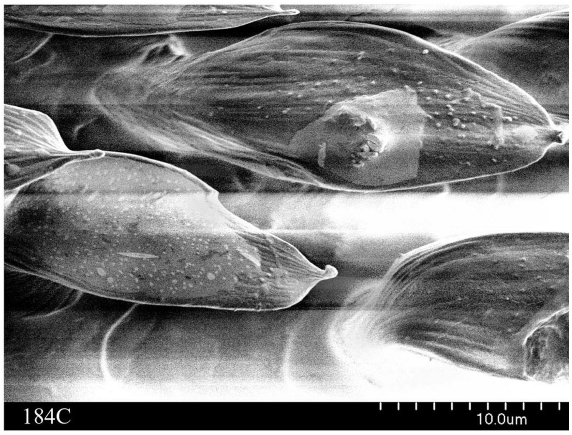

182
500um

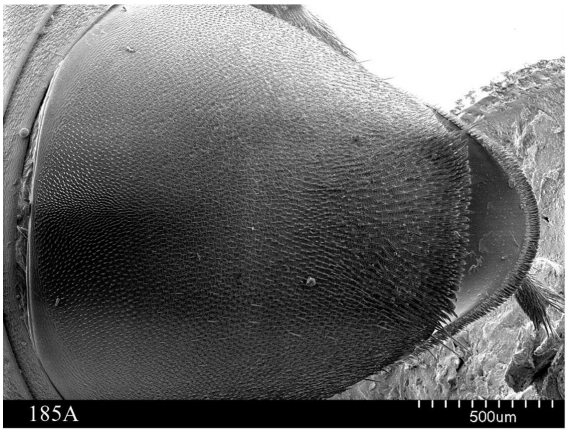

183A
500um

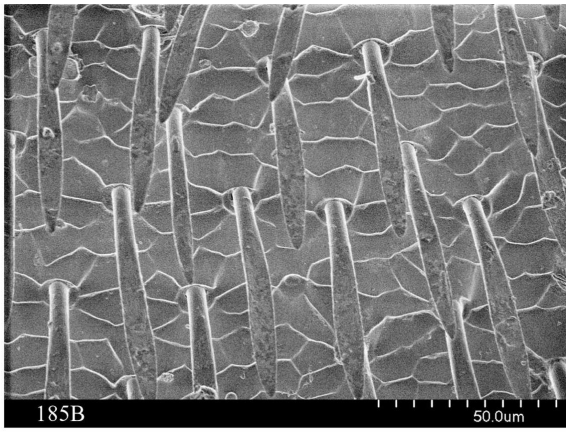

183B
50.0um

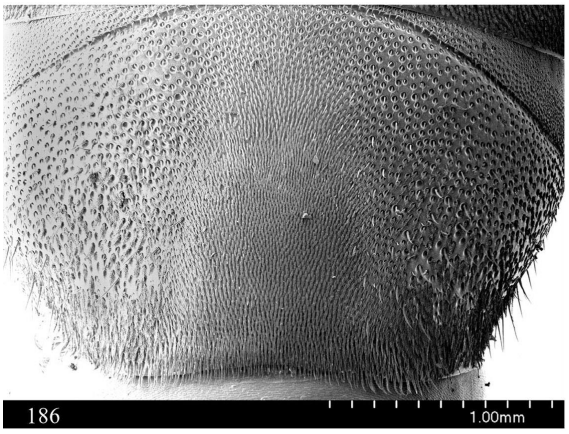

184A
1.00mm

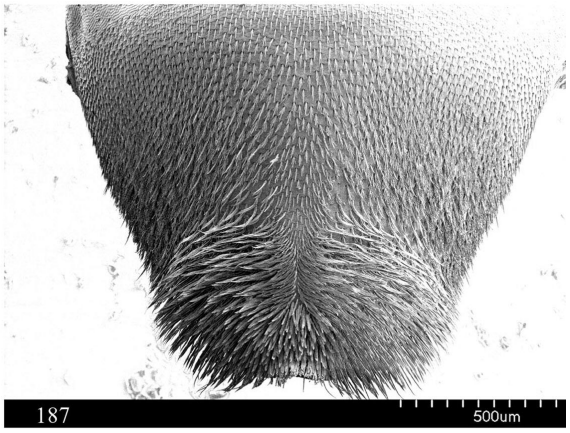

184B
50.0um

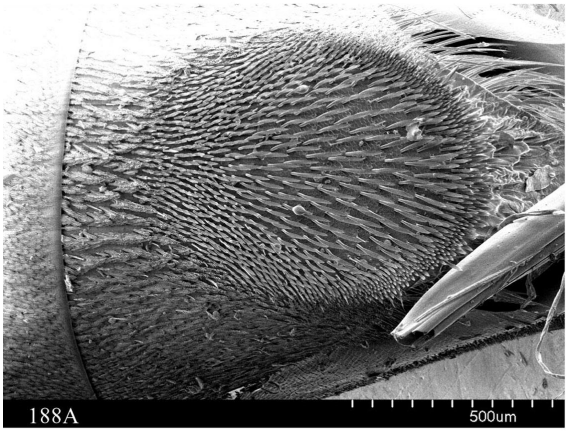

184C
10.0um

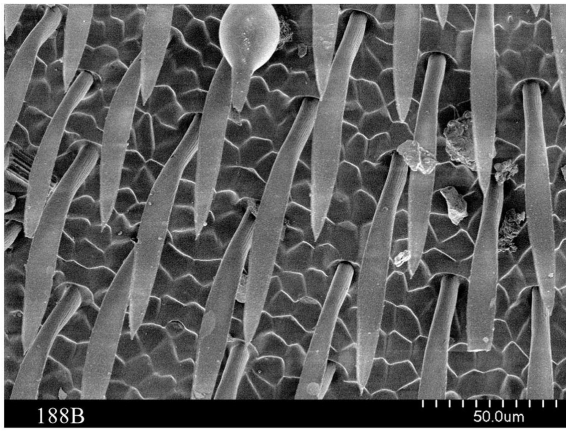

185A
500um

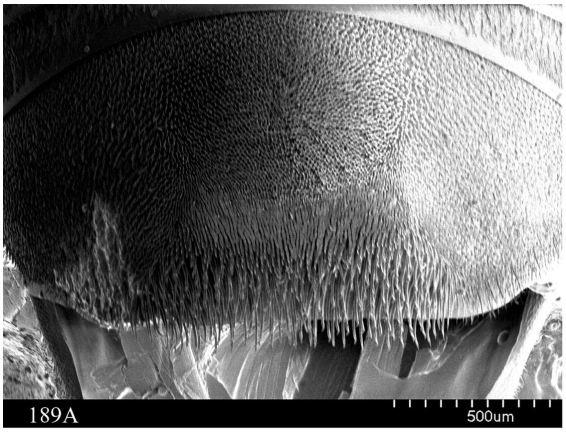

185B
50.0um

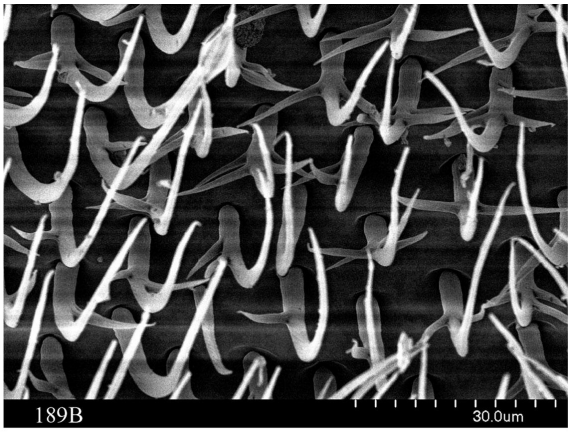

186
1.00mm

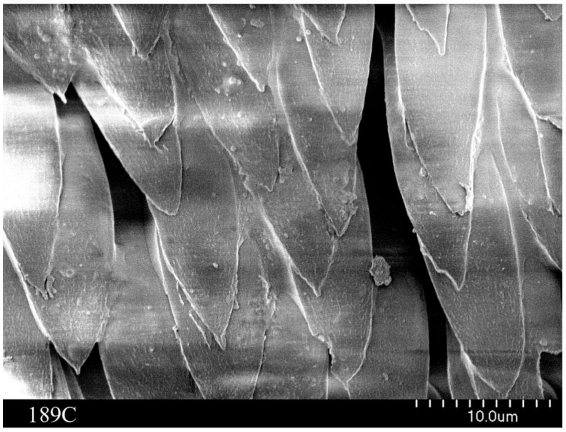

187
500um

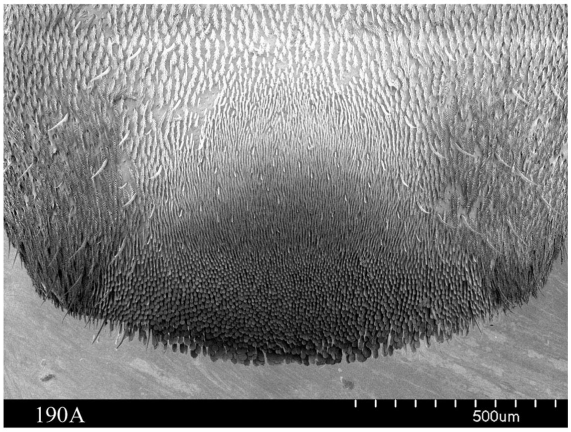

188A
500um

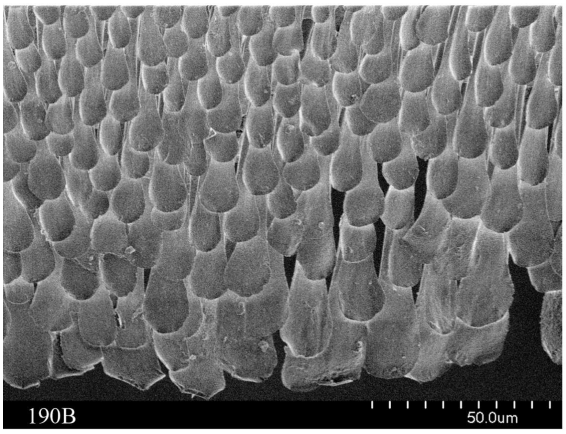

188B
50.0um

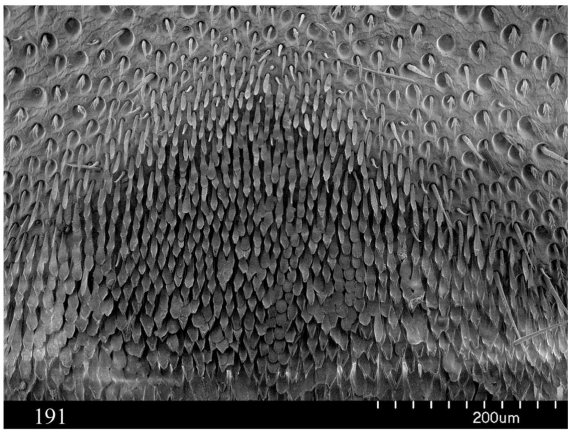

189A
500um


189B
30.0um


189C
10.0um

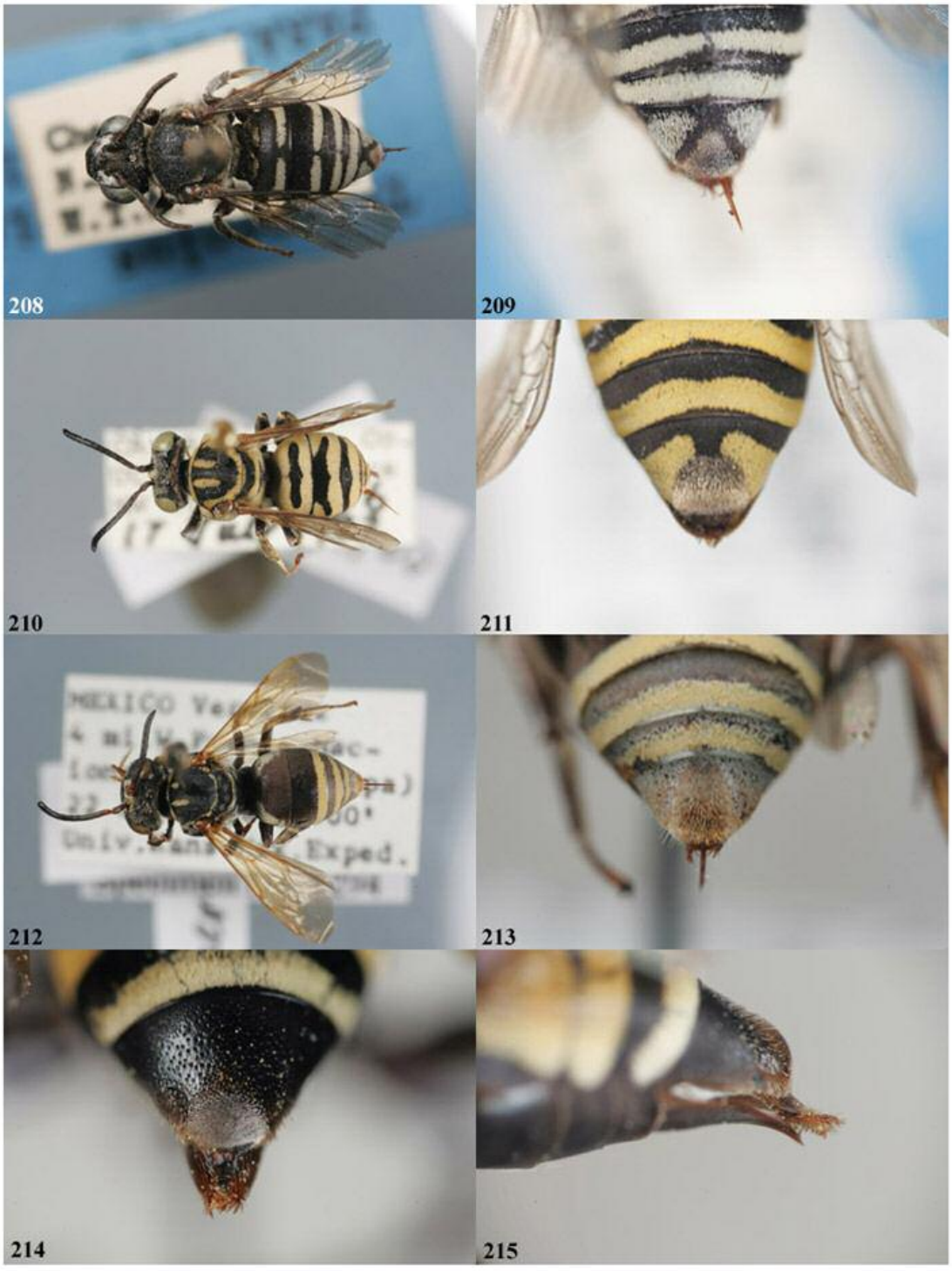

190A
500um

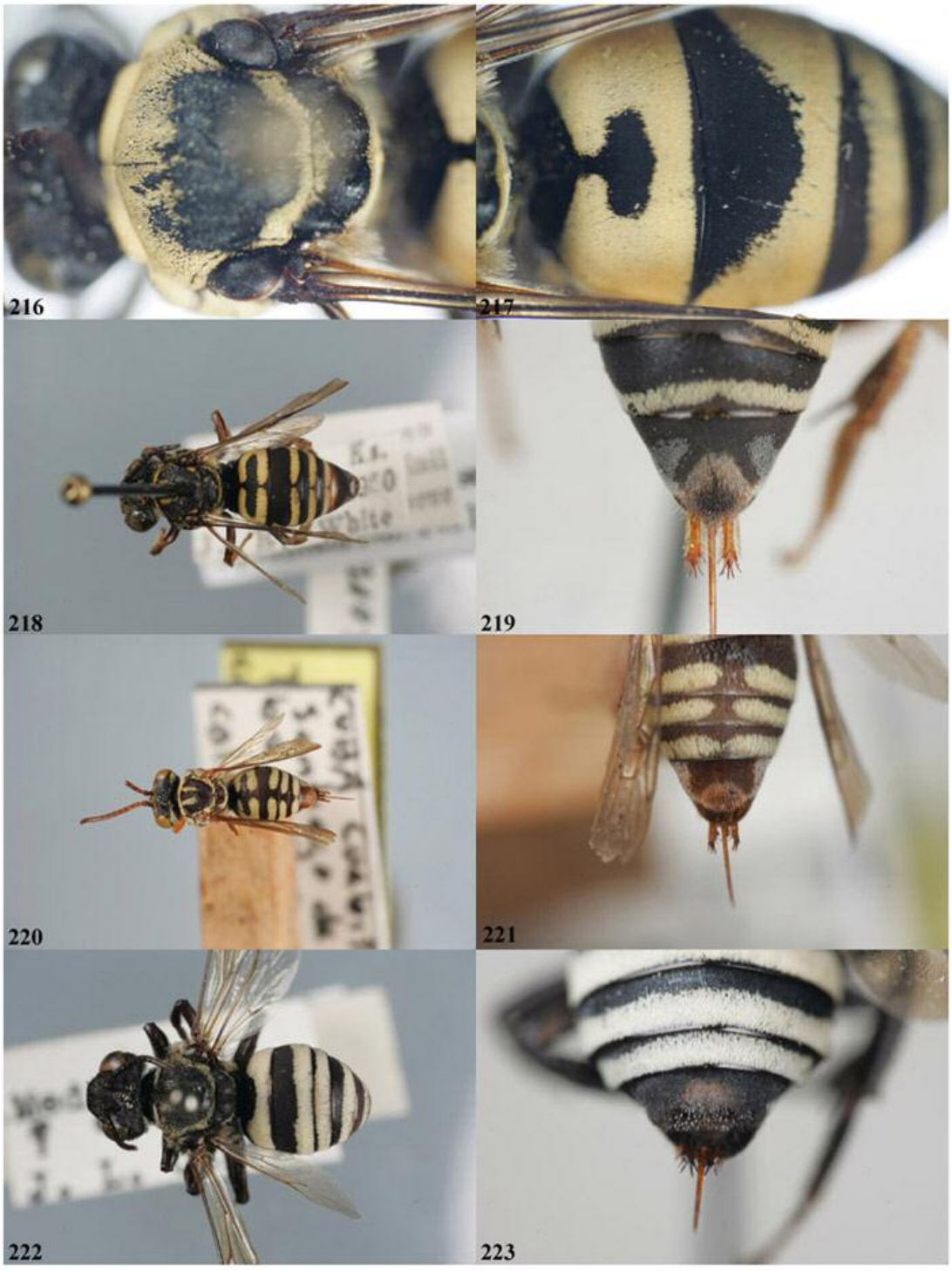

190B
50.0um

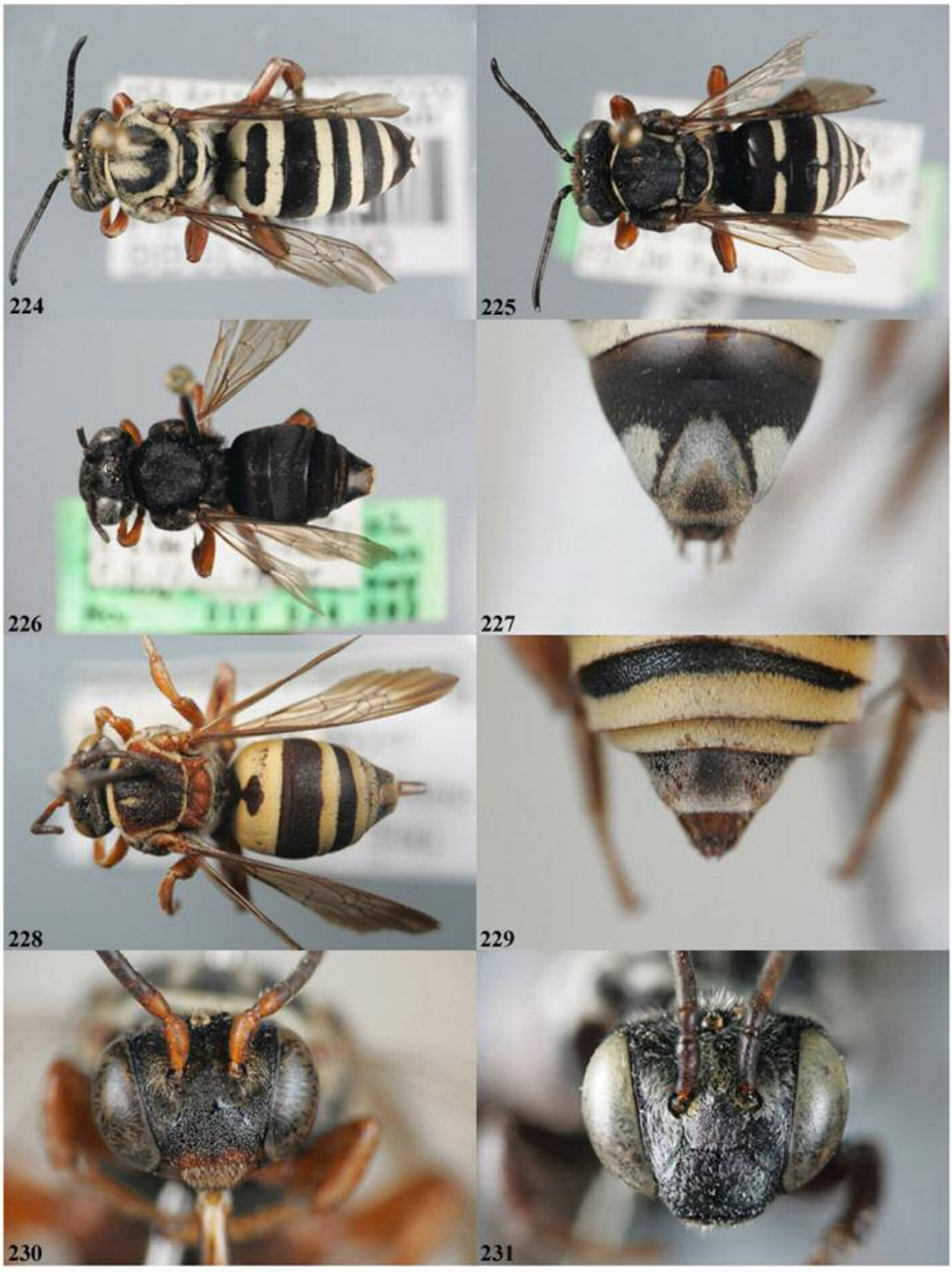

191
200um

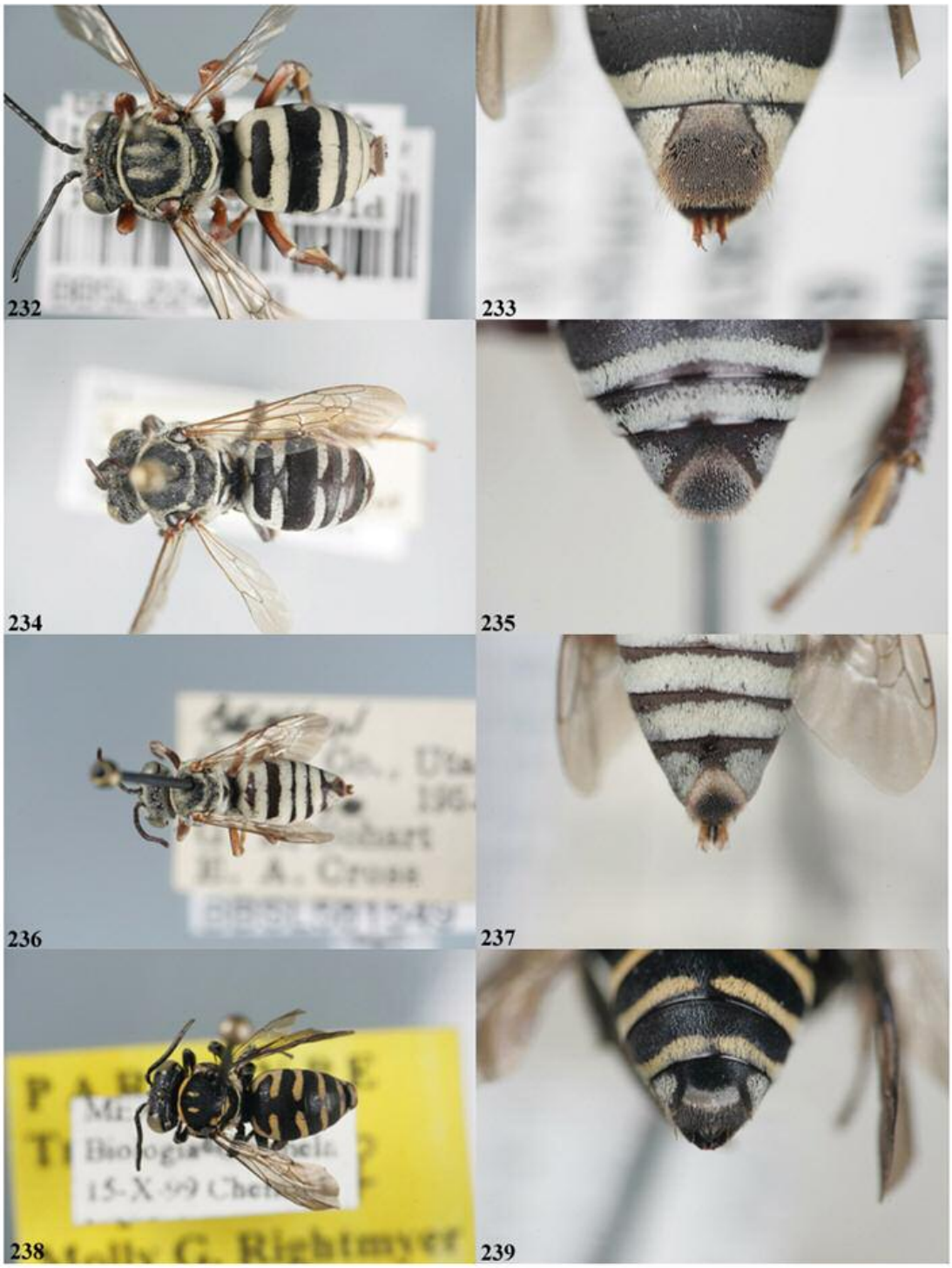

192
193
194
195
196
197
198
199

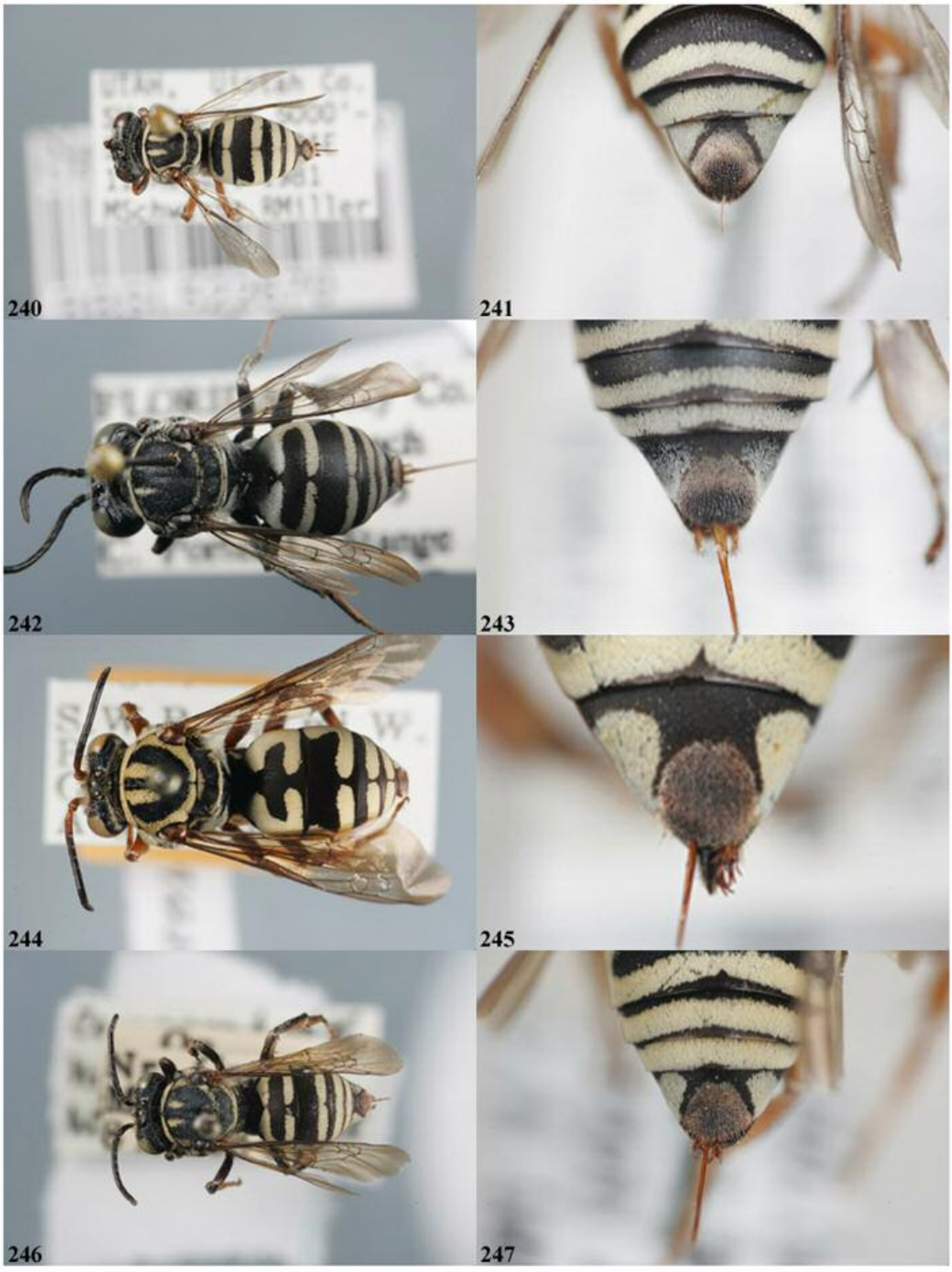

200
201
202
203
204
205
206
207


208
209
210
211
212
213
214
215


216
217
218
219
220
221
222
223

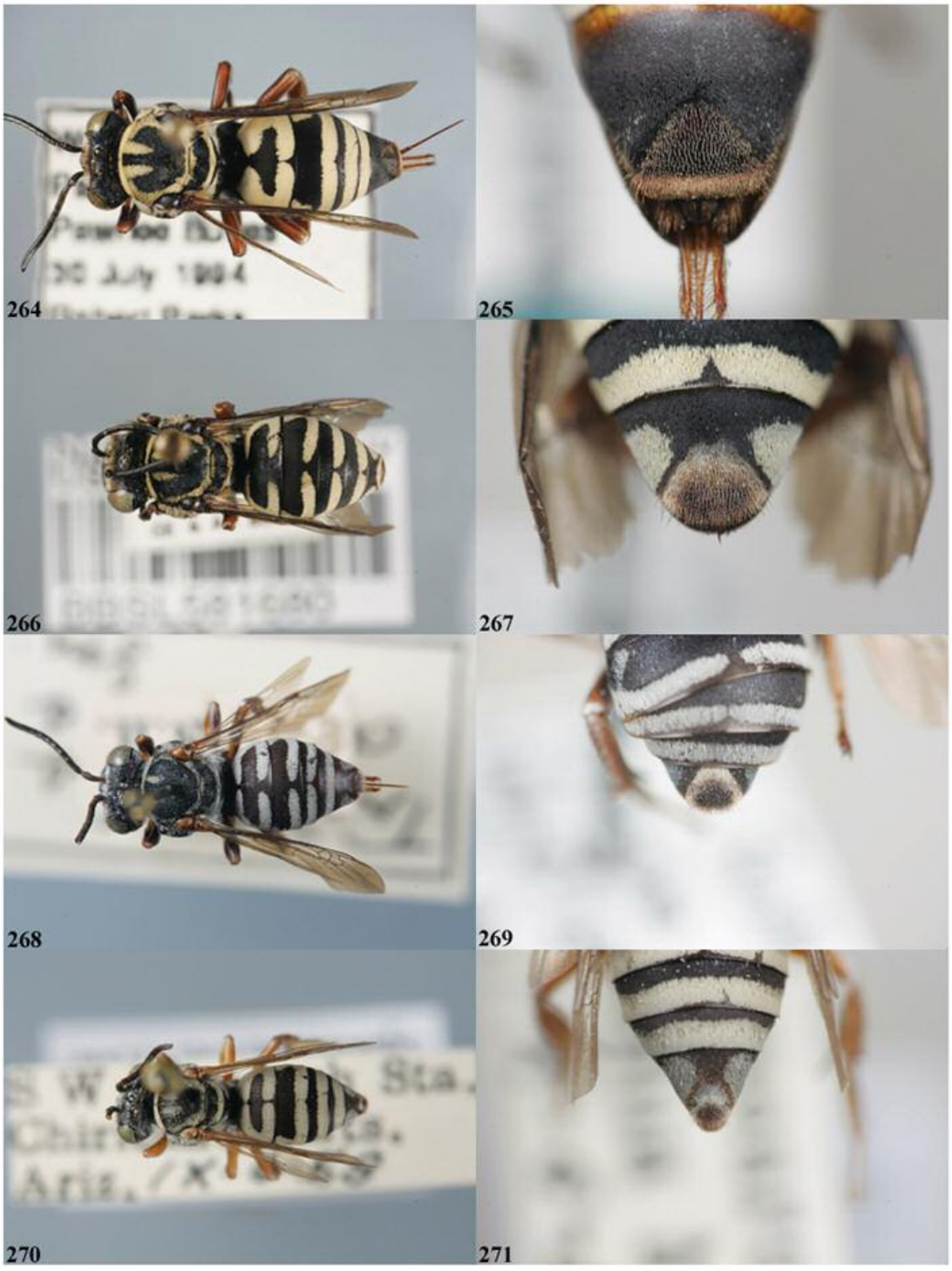

224
225
226
227
228
229
230
231

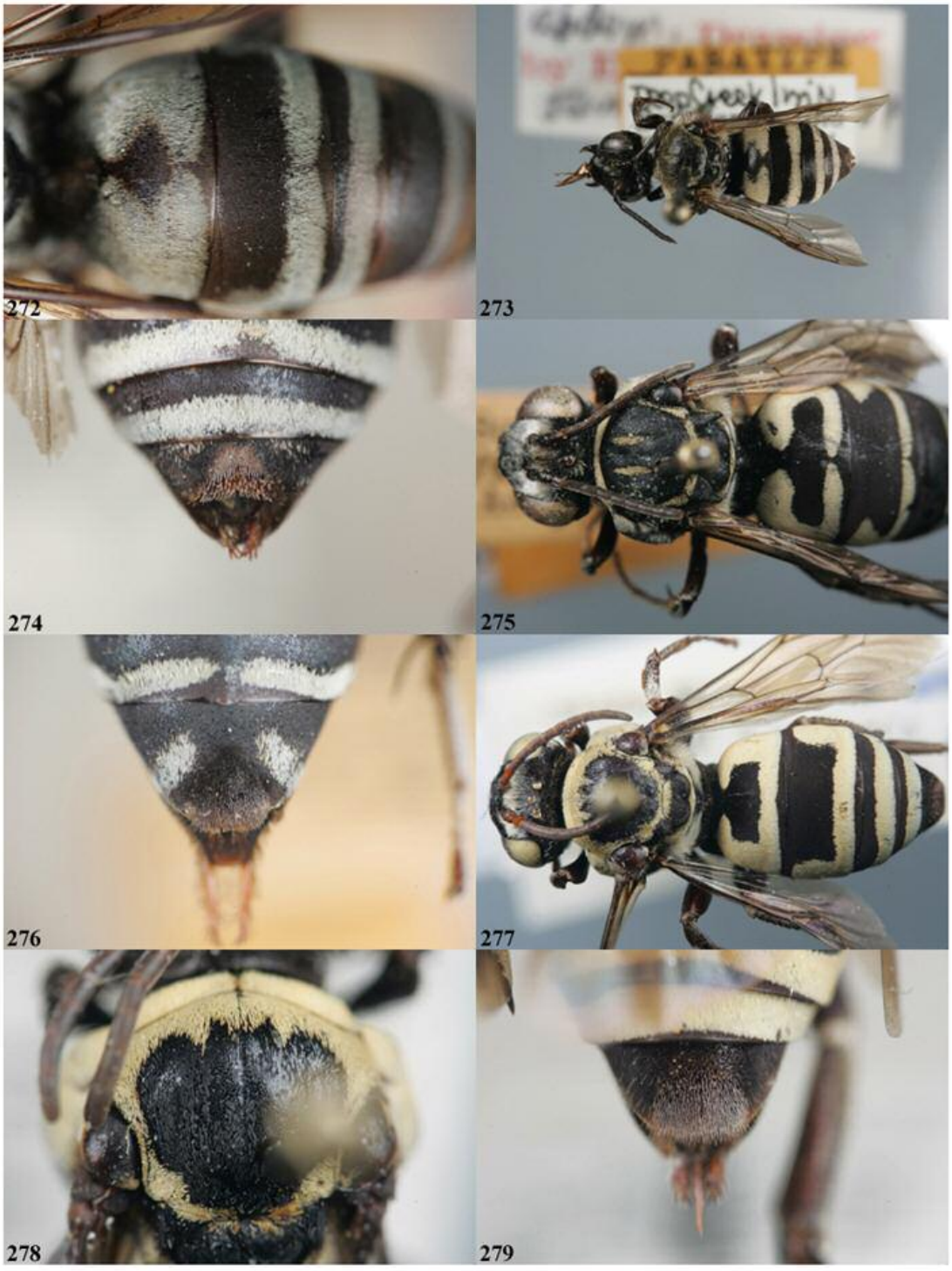

232
233
234
235
236
237
238
239


240
241
242
243
244
245
246
247


248
249
250
251
252
253
254
255


256
257
USA: Ar hise Co.
6mi SW -1-2003
J.G. Rozen & J.S. Ascher
258
259
260
261
262
263

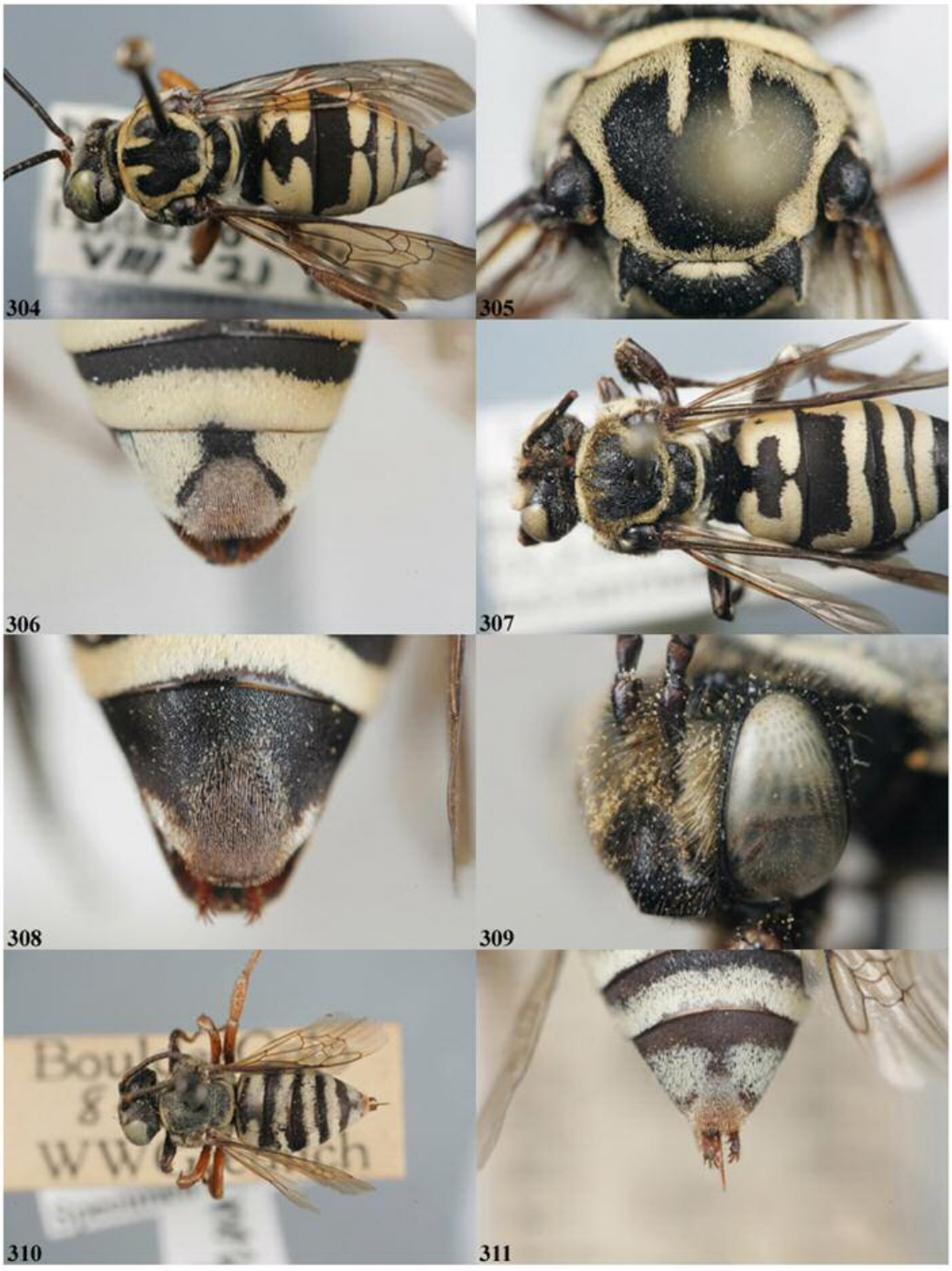

264
265
266
267
268
269
270
271

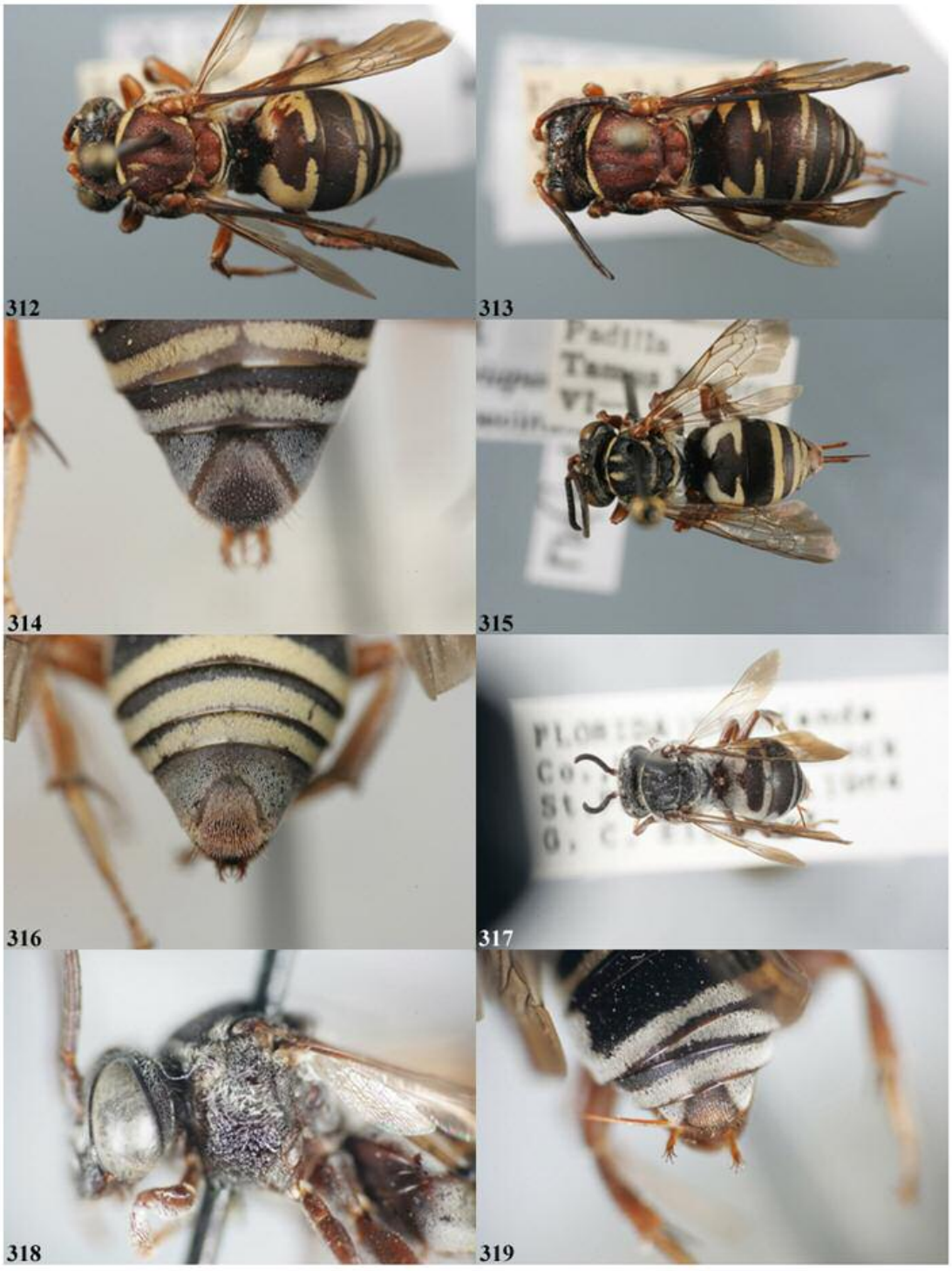

272
273
PARATYPE
274
275
276
277
278
279

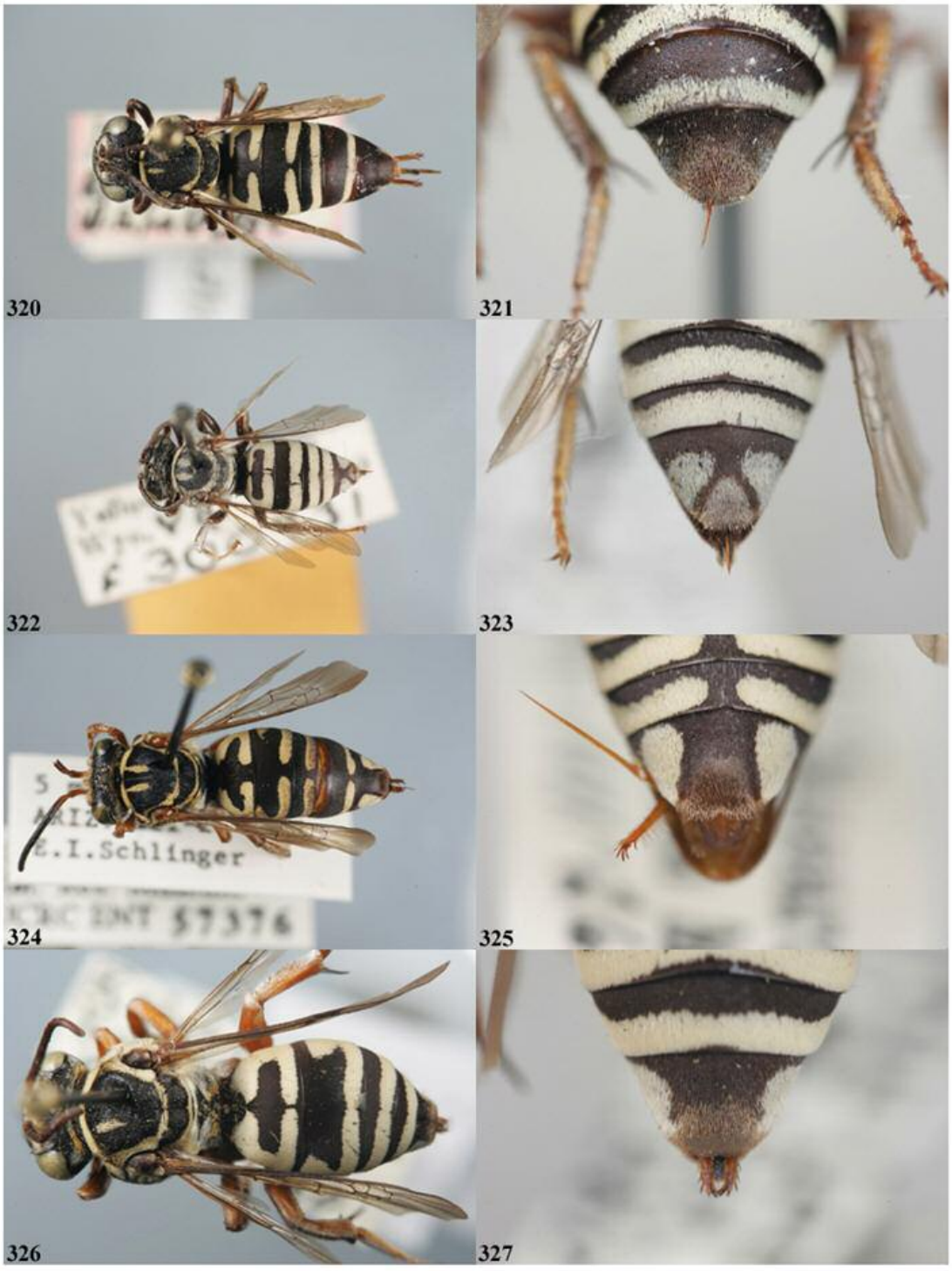

280
281
282
283
PARATYPE
284
285
286
287

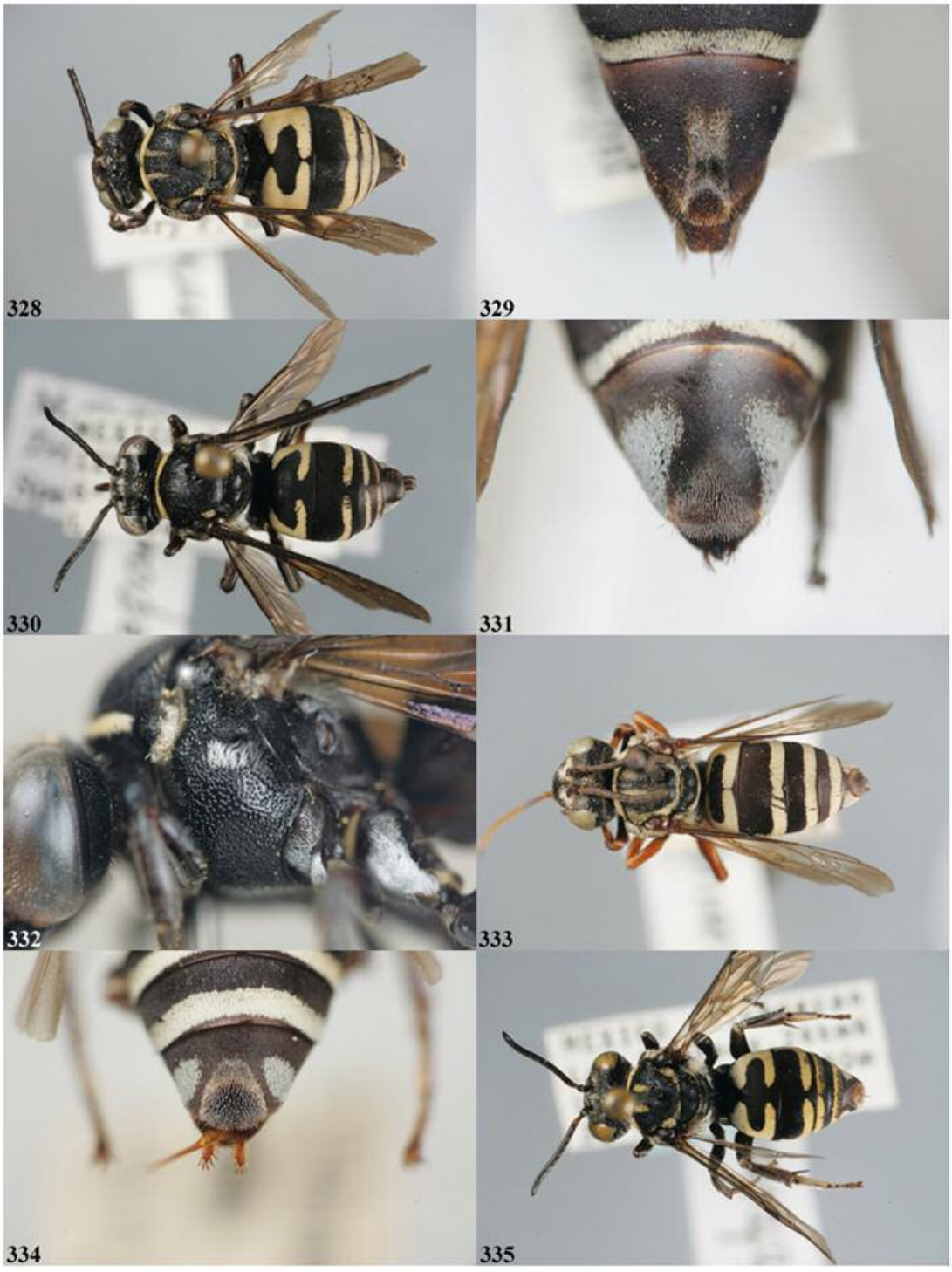

288
289
290
291
292
293
294
295


296
297
298
299
300
301
302
303

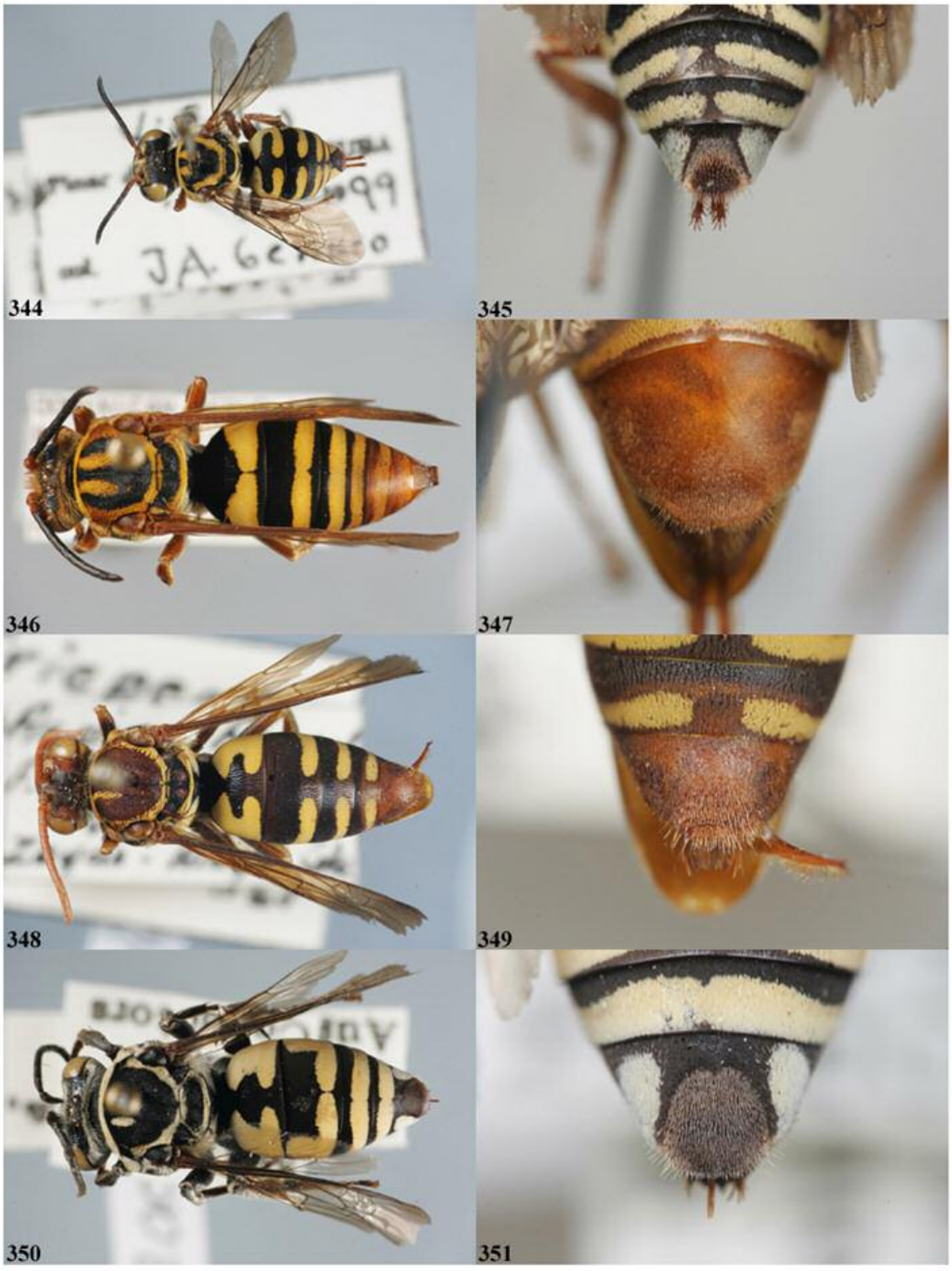

304
305
306
307
308
309
310
311

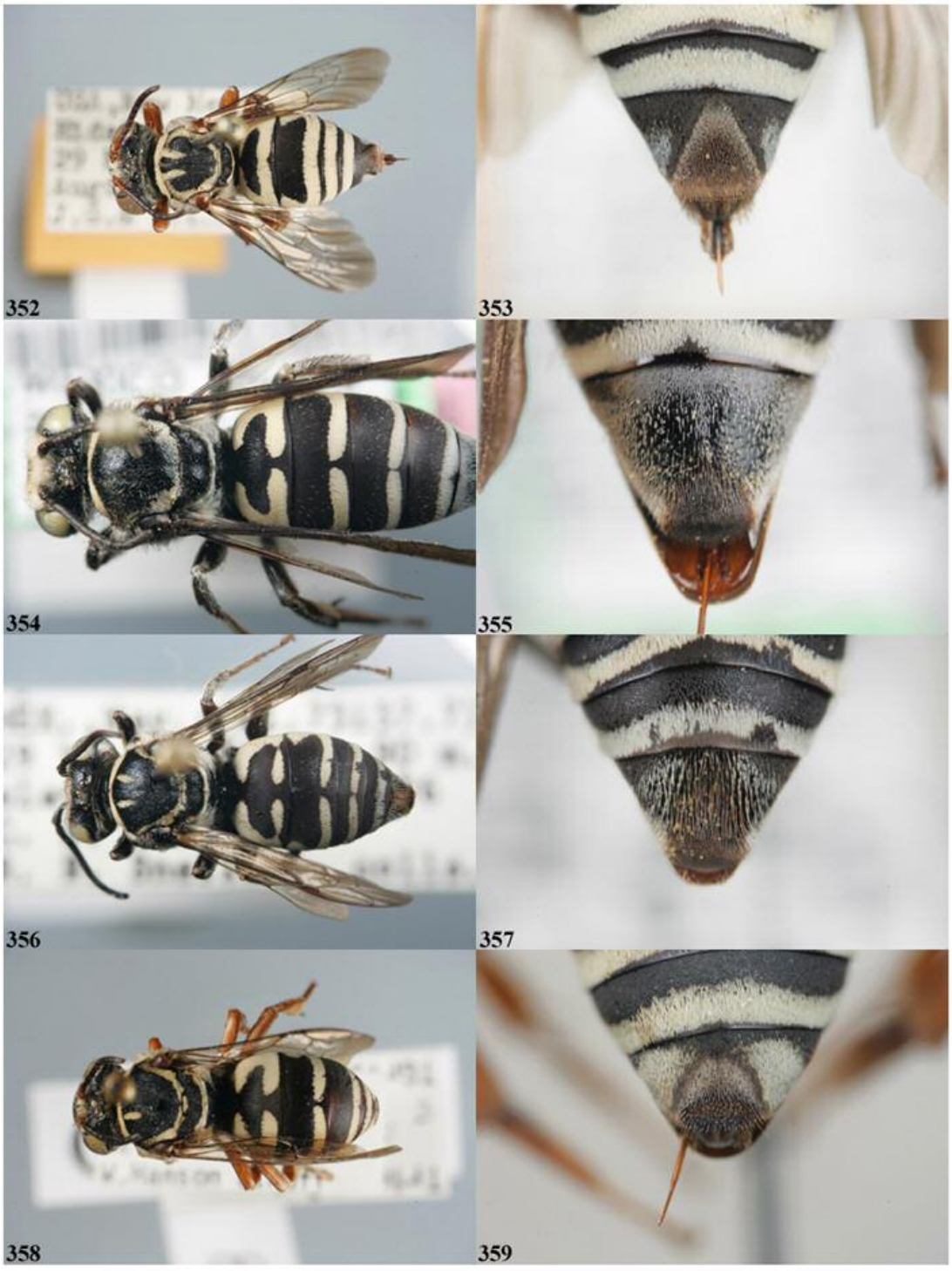

312
313
314
315
316
317
318
319

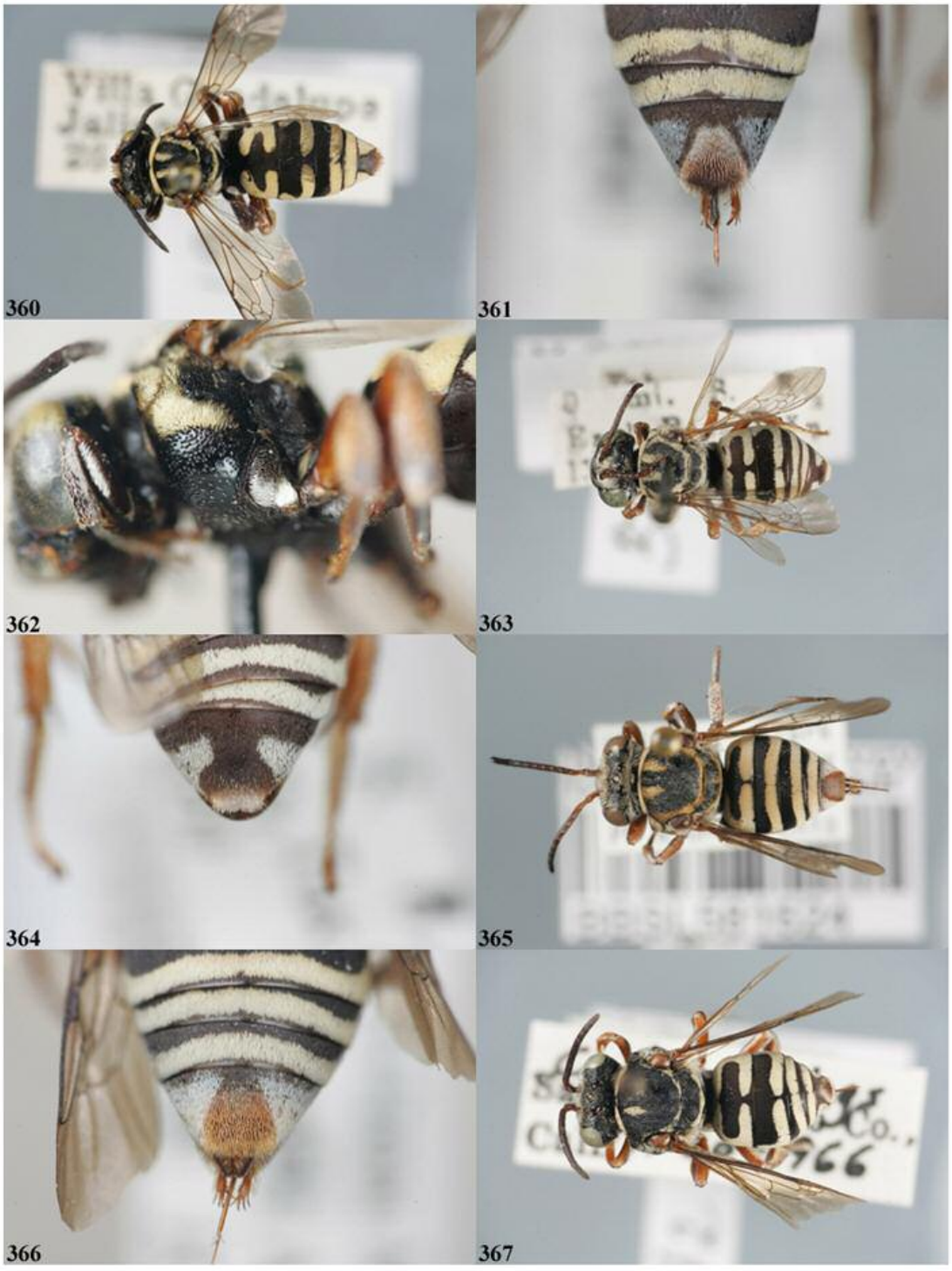

320
321
322
323
E.I.Schlinger
324
325
326
327

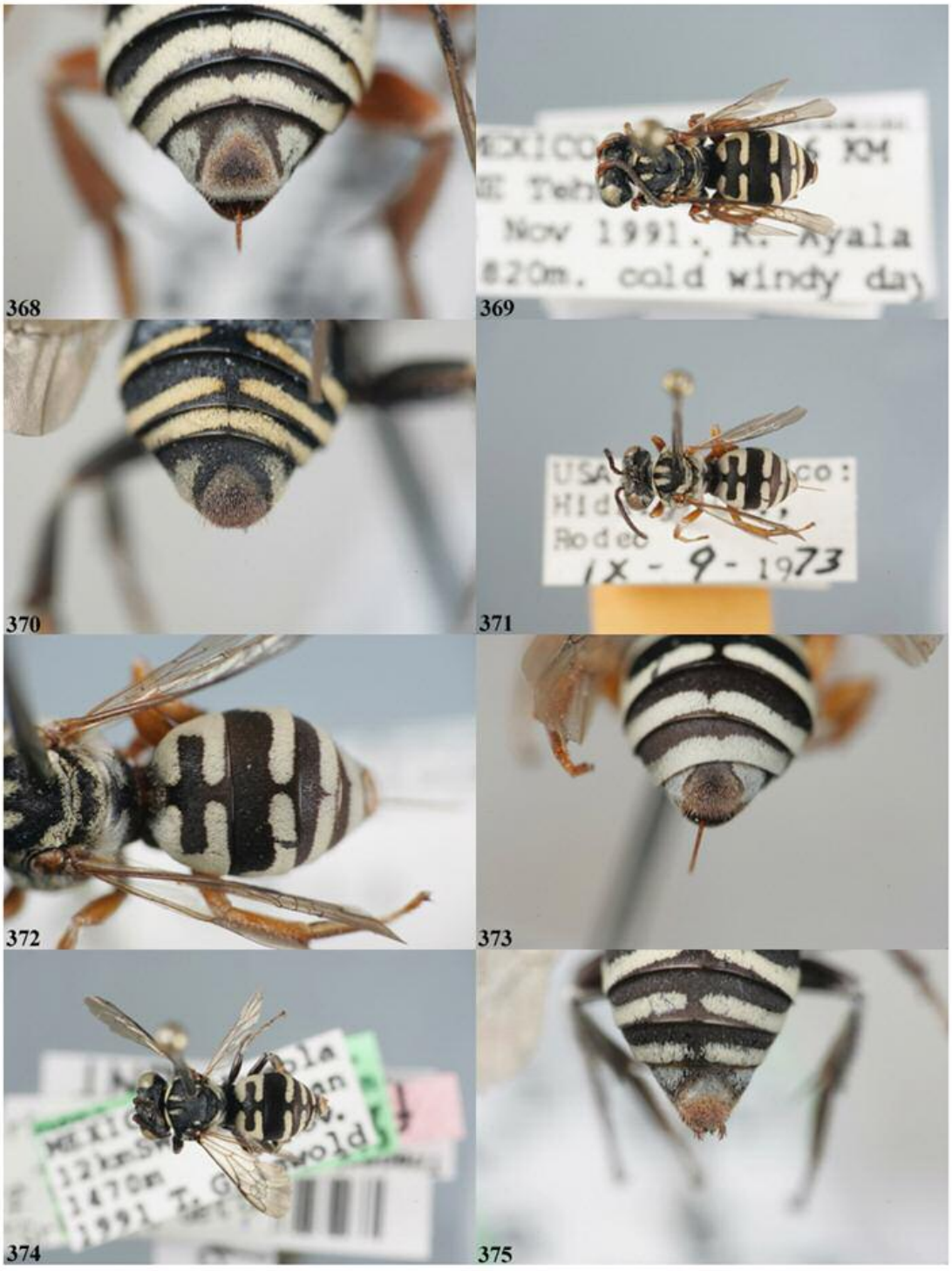

328
329
330
331
332
333
334
335

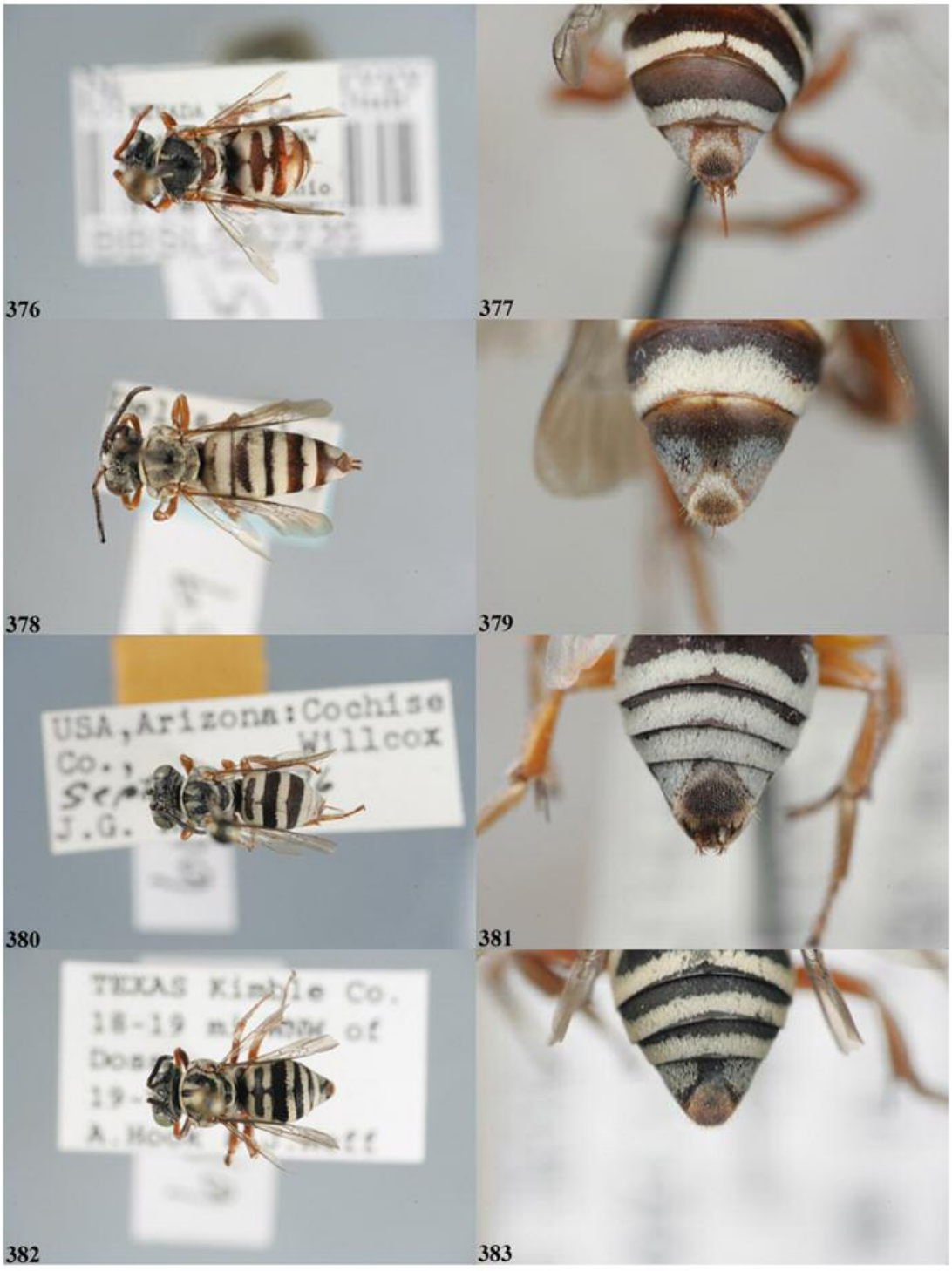

336
337
338
339
340
341
342
343

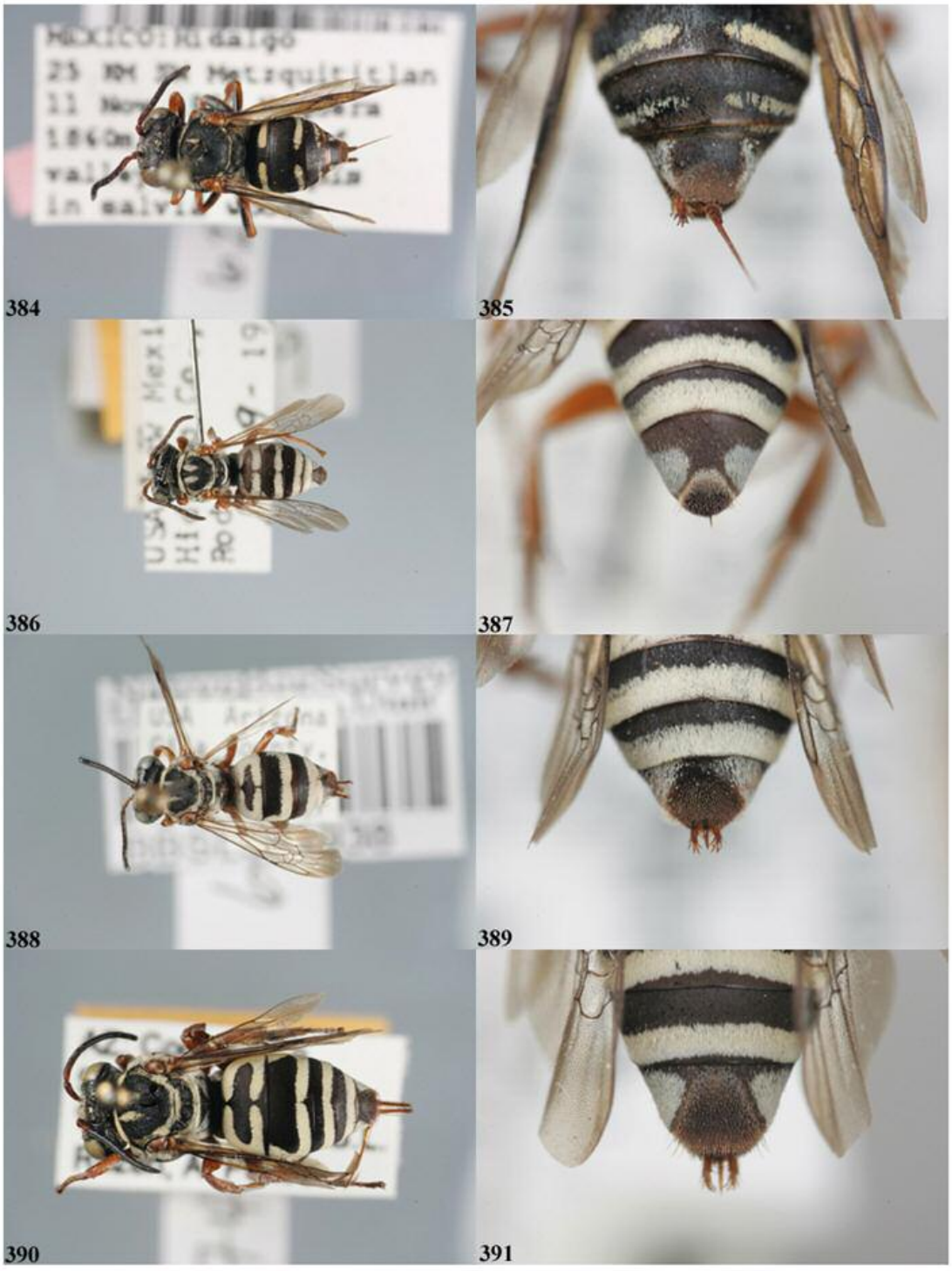

344
345
346
347
348
349
350
351

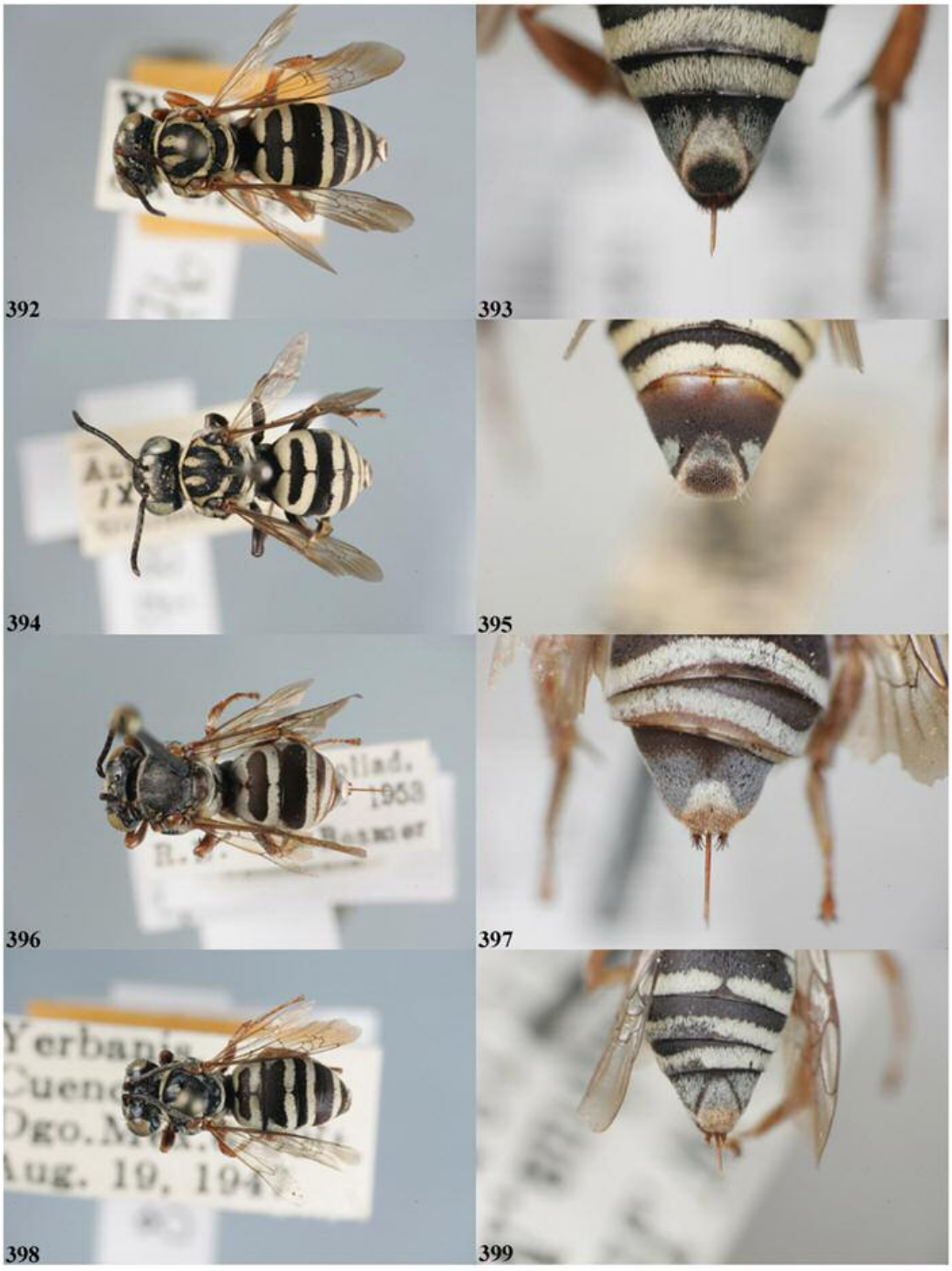

352
353
354
355
356
357
358
359


360
361
362
363
364
365
366
367


368
369
Nov 1991. R. Ayala
820m. cold windy day
370
371
IX - 9 - 1973
372
373
374
375

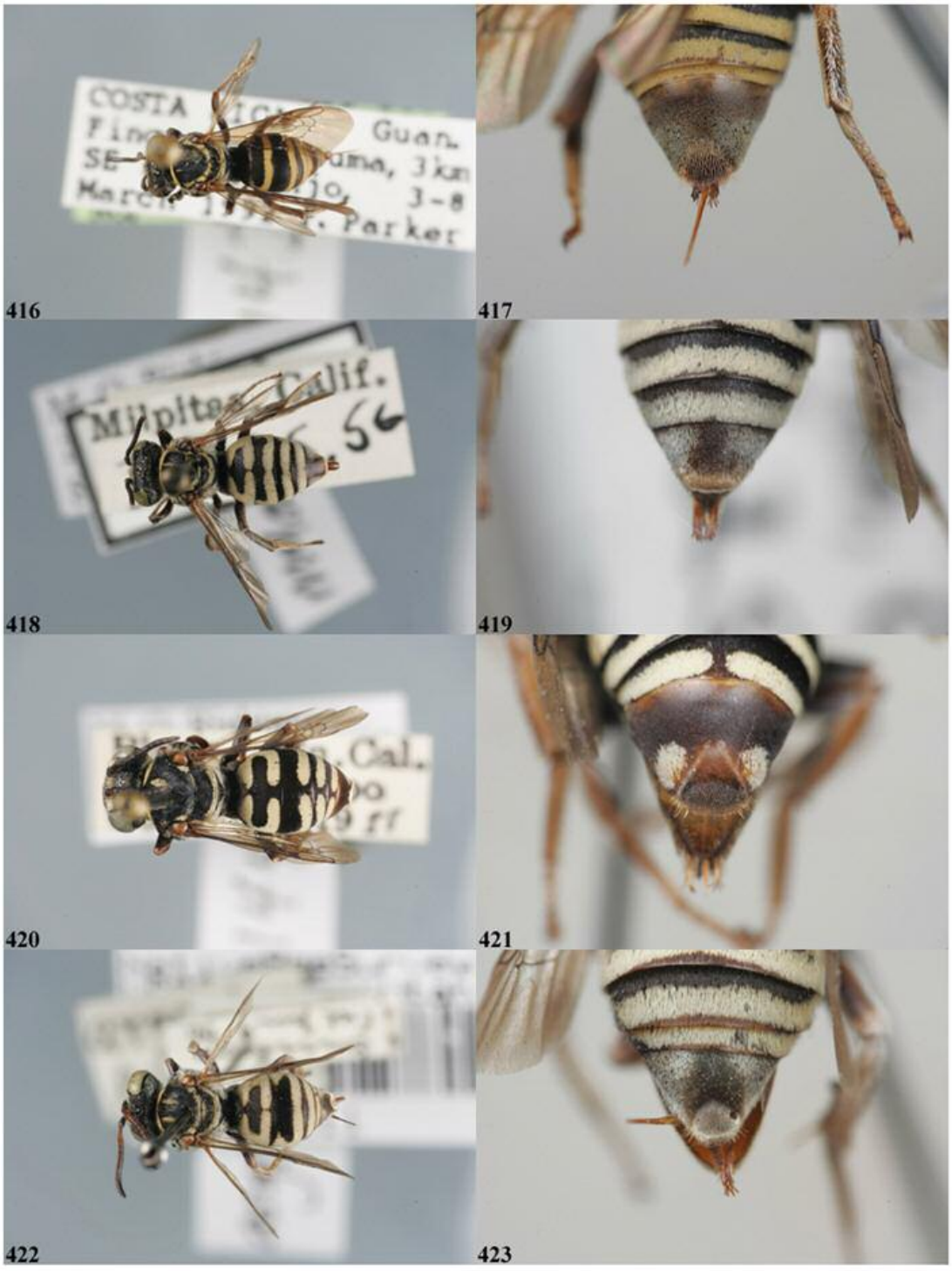

376
377
378
379
USA,Arizona:Cochise
Co.,
Willcox
J.G.
380
381
TEXAS Kimble Co.
382
383

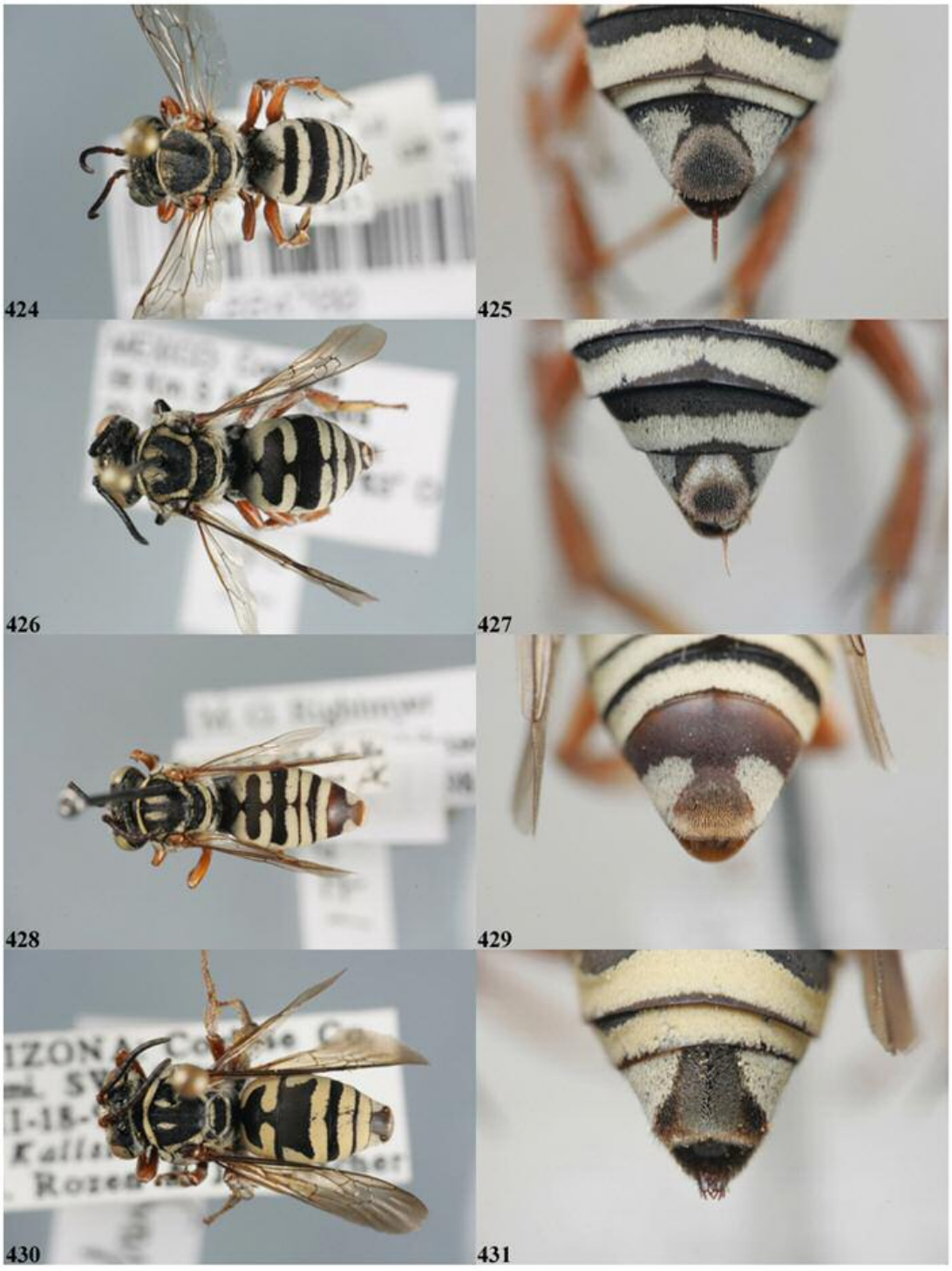

384
385
386
387
388
389
390
391

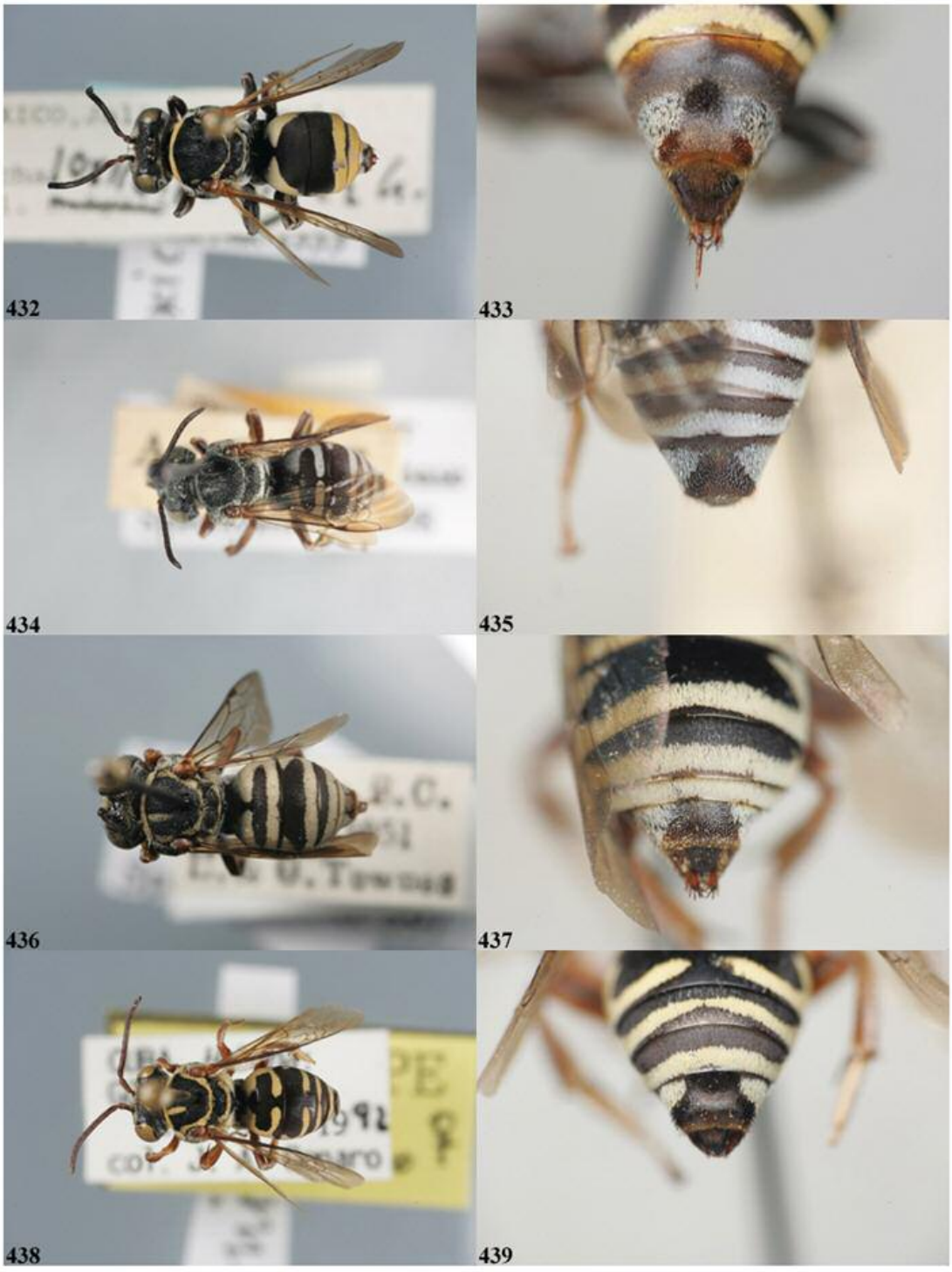

392
393
394
395
396
397
398
399

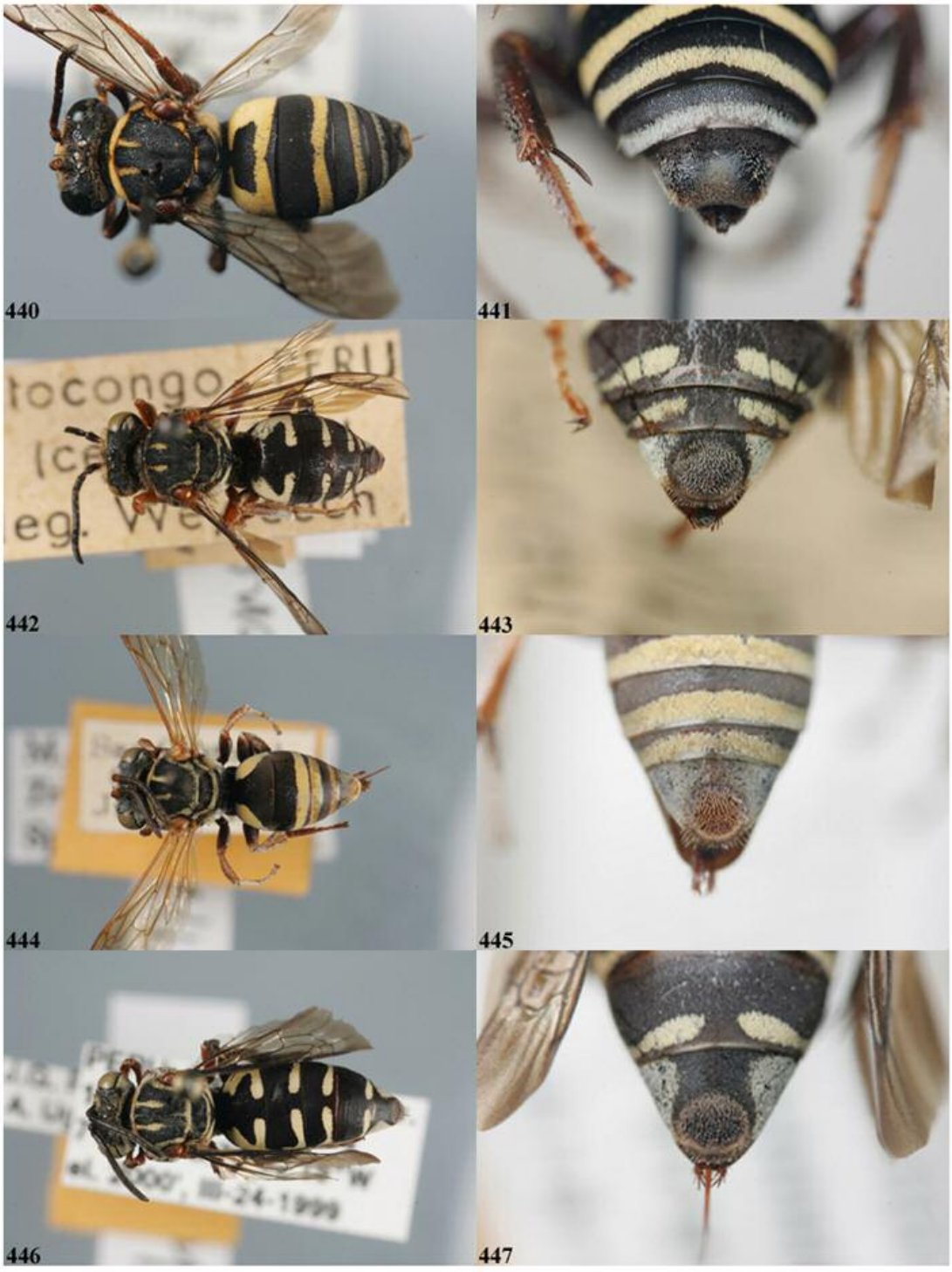

U.S.A.: California
400
401
402
403
404
405
406
407

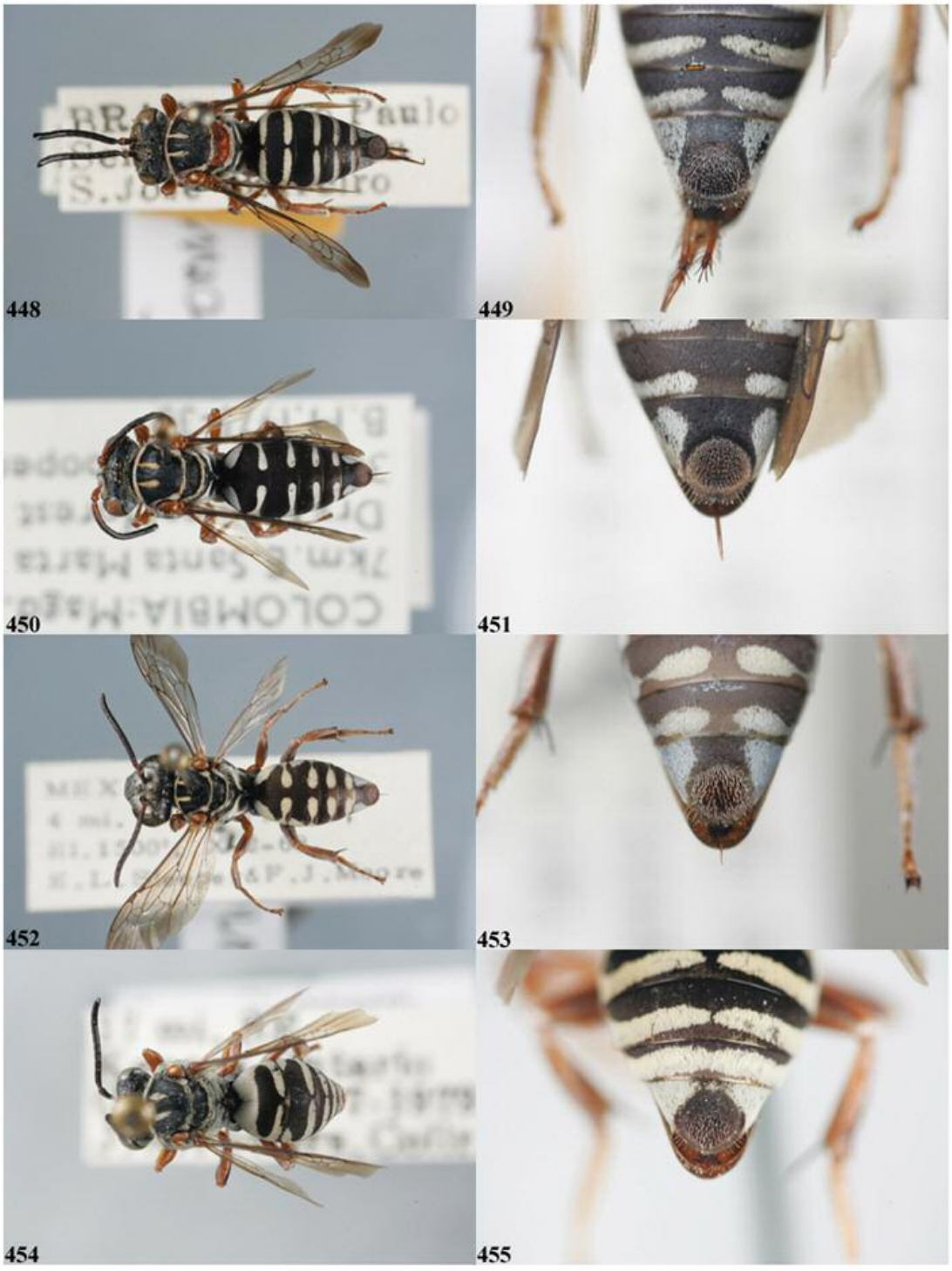

408
409
410
411
412
413
414
415

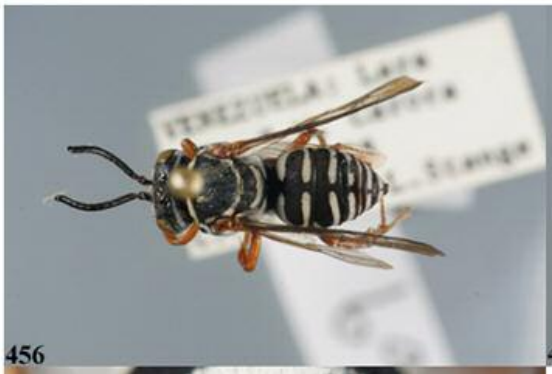

416
417
418
419
420
421
422
423


424
425
426
427
428
429
430
431


432
433
434
435
436
437
438
439

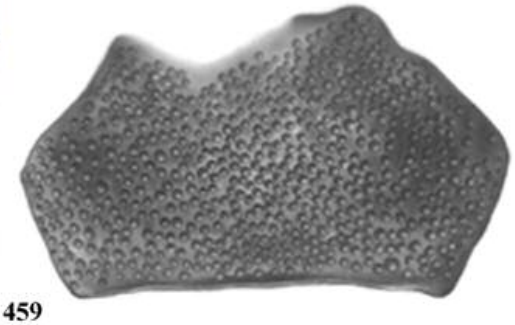

440
441
442
443
444
445
446
447

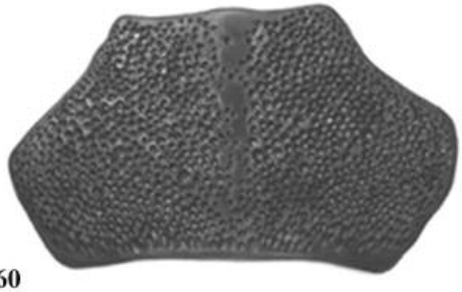

448
449
450
451
452
453
454
455

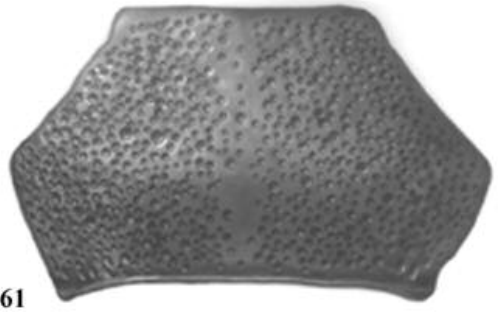

456

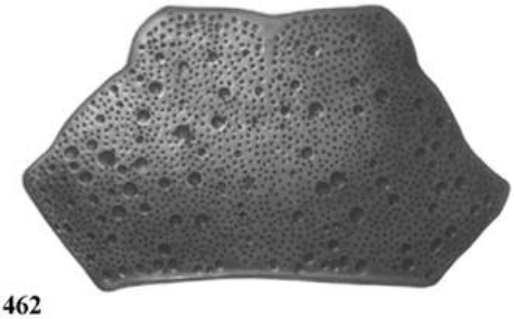

457


458

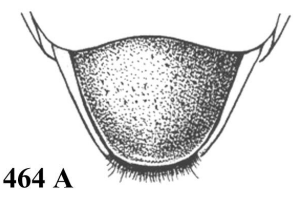

459


460

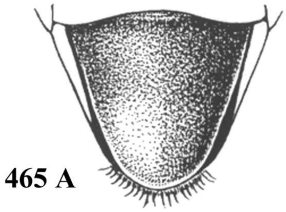

461


462

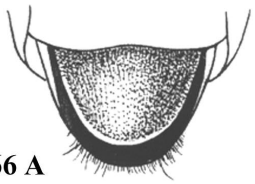

463



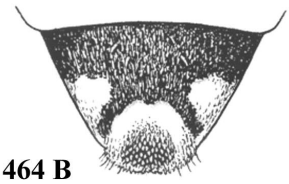
464 A



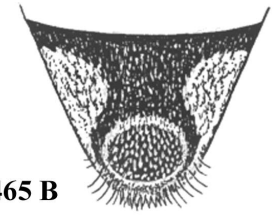
465 A



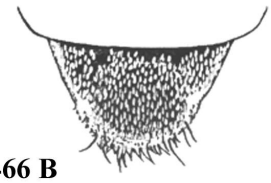
466 A



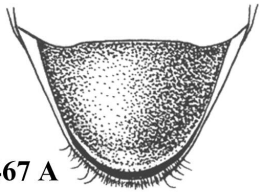
464 B



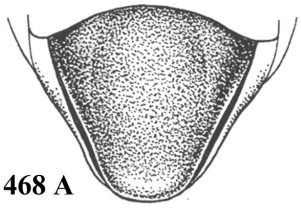
465 B



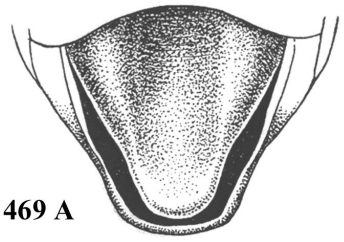
466 B



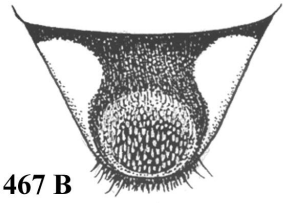
467 A



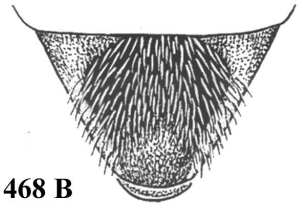
468 A



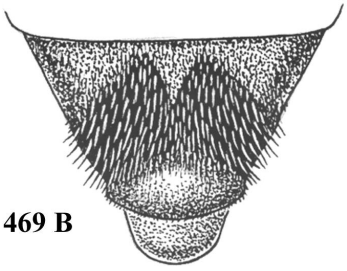
469 A



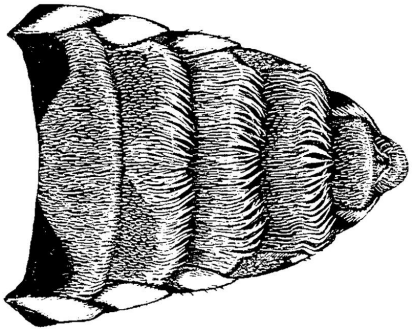
467 B



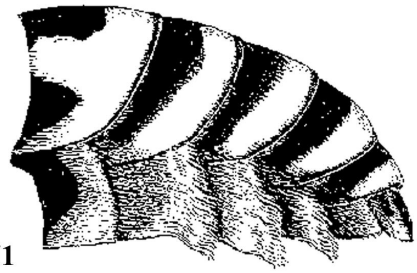
468 B



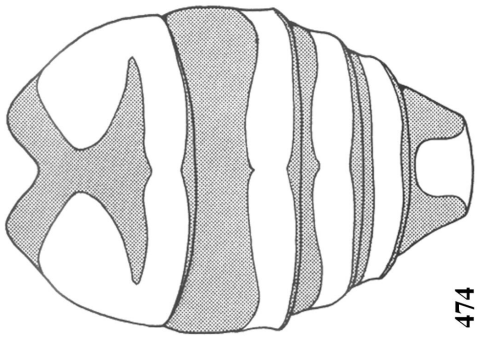
469 B



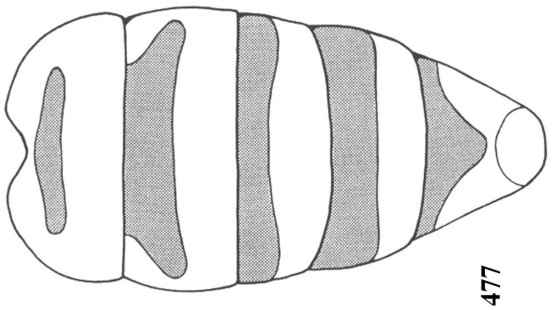
470



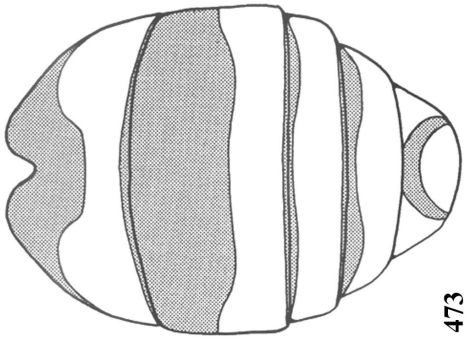
471



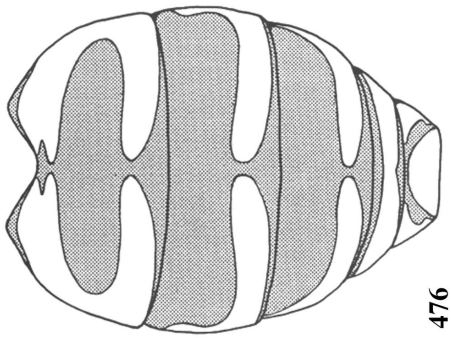
474



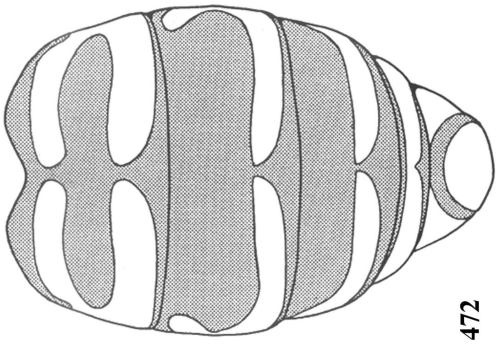
477



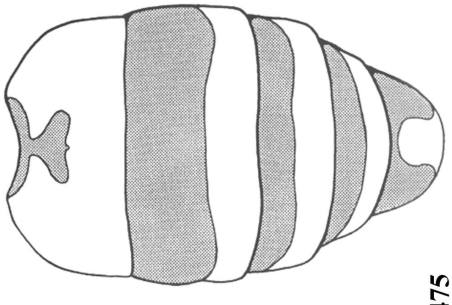
473



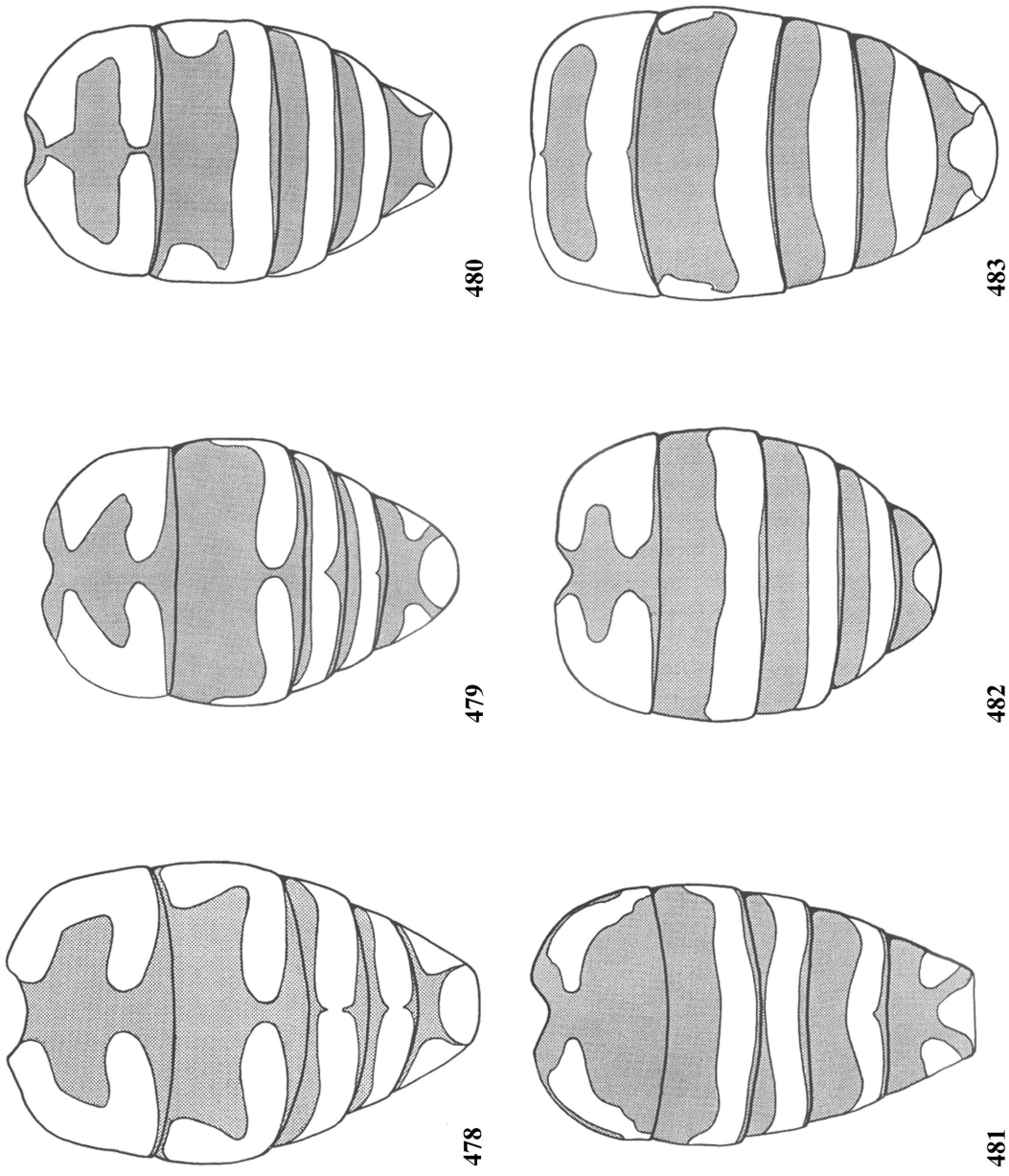
476

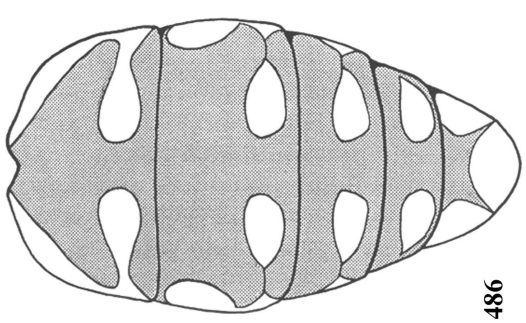


472

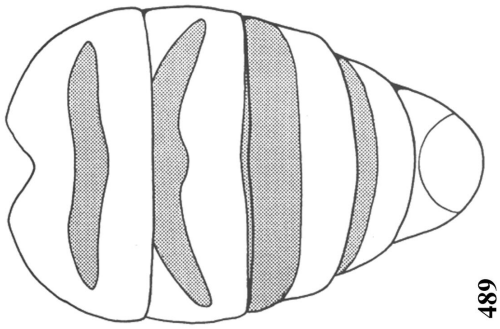


475

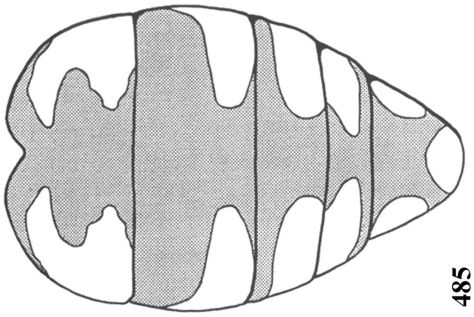

480
483
479
482
478
481



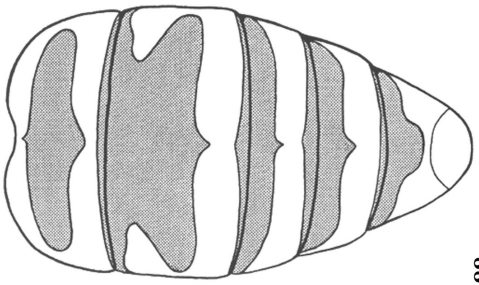
486



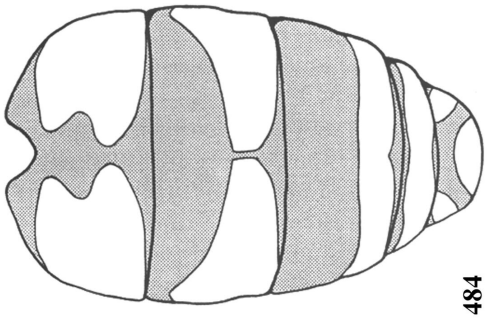
489



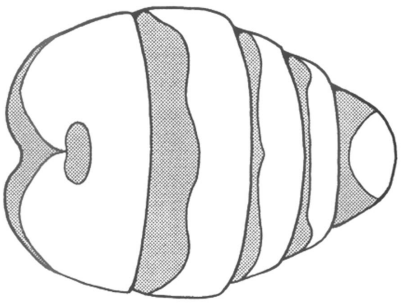
485



488



484



487